REPORT

OF THE

FEDERAL TRADE COMMISSION

ON THE

CONTROL OF IRON ORE

FOR THE

ANTITRUST SUBCOMMITTEE

OF THE

COMMITTEE ON THE JUDICIARY

HOUSE OF REPRESENTATIVES

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LETTER OF TRANSMITTAL

DECEMBER 22, 1952.

To the Members of the Committee on the Judiciary, House of Representatives:

The Antitrust Subcommittee has received from the Federal Trade Commission a report entitled "Control of Iron Ore." This report is the outgrowth of the interest displayed by members of the Subcommittee on Study of Monopoly Power, predecessor to the Antitrust Subcommittee, when hearings on the iron and steel industry were held in 1950.[1]

At that time, the iron and steel industry had produced record amounts of the vital material so important to the Nation's economic life and security. It had played a major role in building the ships, tanks, and guns which contributed to the successful termination of the then recent hostilities. It had assumed the even more vital task of reconstructing the war-torn world and in restoring, in great measure, the peacetime industrial potential destroyed in that conflict. Once again, upon the commencement of hostilities in Korea, the importance of iron and steel to the security of the country has been demonstrated over and over again. All this, however, has not been without cost.

The drain of two great wars and an ever-expanding economy has seriously depleted the known reserves of high-grade easily minable ore. The importation of ore from foreign sources without the control of the United States and the utilization of low-grade domestic ores is likely to create additional problems within the competitive framework of an already highly concentrated industry. Technological innovations and the expansion of facilities under the aegis of emergency Government incentives will also not be without effect upon the structure of the industry as it is known today.

It is appropriate, therefore, that this report contains a definitive study of the problems relating to the supply of iron ore as they pertain to competition and free enterprise within the iron and steel industry. The subcommittee wishes to commend the Federal Trade Commission and its staff for the fine work it has done to make this timely and important study.

EMANUEL CELLER, *Chairman.*

[1] Hearings, Committee on the Judiciary, Serial 14, Pts. 4 A and B; committee print report, dated December 19, 1950.

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CONTROL OF IRON ORE

PART I

IRON ORE AND COMPETITION

In response to increased defense needs, the productive capacity of the iron and steel industry is undergoing a rapid expansion. If the output of steel is to keep pace with this enlargement of capacity, vastly increased quantities of iron ore must be fed to the steel mills. The ore requirements for capacity operations at the end of 1952, when the expansion program is scheduled for near-completion, have been estimated to be in the neighborhood of 143 million gross tons.[1] The figure represents an increase of roughly 40 percent over 1948 requirements.

There appears to be general agreement that the supply of readily accessible, high-grade domestic ore is gradually running out. Although there is disagreement among the experts as to the policies best calculated to accomplish a change-over to new sources of supply with the least disturbance, the existence of a serious problem of orientation is not in dispute. The words and acts of industry officials during the last several years have recognized the seriousness and immediacy of the problem.

There is also general agreement that scrap, another important raw material for steel making, can do little to alleviate the heavy demand for iron ore during the present emergency. Scrap produced incidental to mill operations and so-called prompt industrial scrap, purchased scrap which flows directly back to the mills, will, of course, be increased in volume as steel production is raised. But the situation is quite otherwise with respect to obsolescent scrap. Most iron and steel products, it is estimated, have an average life of approximately 20 years before they find their way back to the steel furnaces. The scrap "crops" to be harvested during the next few years are those sowed in the early 1930's, the years of the great depression, when steel production and fabrication were unusually small. At a time, therefore, when steel output is scheduled to soar to unprecedented heights, the Nation is likely to be short of scrap. This scrap shortage will place even heavier demands upon the iron-ore market.

The depletion of domestic high-grade ore, coupled with the shortage of scrap, has led the Nation's principal steel producers to look elsewhere for their future supplies of ore. It is obvious that the steel industry is now beginning a shift from almost complete reliance on high-grade domestic ores to substantial reliance on foreign ores and probably to a lesser extent on lower-grade domestic ores, including taconites.

This shift in the sources of supply will have far-reaching consequences upon the economics of steel making, including cost structure,

[1] Steel Facts, February 1951, No. 106, p. 2. (Converted from net tons to gross tons.)

pricing arrangements, location of facilities, rate and character of technological advance, and similar matters.

One effect is of particular interest to the Federal Trade Commission. This is the impact of the depletion of high-grade domestic ores and of the gradual shift to foreign or lower-grade domestic ores upon competitive conditions in the industry. Will the pressures of circumstance attending this shift set in motion new competitive forces in the industry? Or will the effect be to lessen competition and promote monopoly?

It is to this question of the future of competition in the steel industry, resulting from the shift to other sources of ore supply, that this particular report is addressed. The Commission has no special knowledge or expertness concerning various other aspects of the iron-ore problem, such as the important question whether our domestic ores will be substantially depleted in 10, 20, 30, 40 years or more.

In order to gain insight into the iron-ore problem the Commission instituted an investigation of the production, distribution, and consumption of iron ore. Questionnaires relating to ownership of reserves as of 1949, and to production of ore for selected years, were sent to the nine principal ore-holding interests of the country. Five of the companies from which information on ore supplies was obtained are among the most important integrated steel producers of the country; the four others are merchant ore houses. Information on consumption of iron ore and other metals was requested from the nine leading steel companies of the country. The data thus brought together cover approximately 85 percent of the country's annual production and consumption of iron ore and approximately 90 percent of the country's ore reserves.

THE USES OF IRON ORE IN STEEL MAKING

A large proportion of the steel produced in the United States is made from pig iron, which, in turn, is produced in blast furnaces. The blast-furnace process consists of charging iron ore, coke, and limestone into the top of the furnace and introducing a heated air blast near the bottom. Differences in the quality of the ore consumed and in operating conditions affect the quantity of raw materials used in making a ton of pig iron, but, on the average, approximately 1.94 gross tons of ore, 1.54 net tons of coal (converted into 1 net ton of coke), and 0.45 gross tons of limestone are required to make 1 gross ton of pig iron.[2] In the operation, the ore supplies the iron; the coke is the source of heat and the means of reducing iron oxide to metallic iron; and the limestone, which is basic in character, combines with such impurities as silica, alumina, and other acid metals of the charge to form slag.

To insure proper operation of the blast furnace, the iron ore must sometimes be treated before smelting. Phosphorus, sulfur, copper, and other unwanted materials are partly eliminated in this preliminary treatment. Some of the substances are of value, but the primary objective is to increase the iron content of the charge and to produce pig iron of higher quality. Large lumps of ore are crushed so that

[2] Daugherty, de Chazeau, and Stratton, The Economics of the Iron and Steel Industry, vol. 1, p. 15.

the iron may be more readily extracted, and finely divided material is sometimes agglomerated into lumps or pellets.

In 1948 the steel industry used 103.8 million gross tons of iron ore to produce nearly 62 million net tons of pig iron.[3] In turn, this quantity of pig iron was combined with steel scrap to produce steel. In a sense, steel scrap constitutes a vital raw material. One ton of scrap is equivalent in iron content to approximately 2 tons of ore. The combination to produce steel is, on the average, 50 percent pig iron and 50 percent scrap, with the scrap roughly divided into two classes of approximately equal quantity, i. e., home scrap and purchased scrap. These proportions represent average ratios as applied to all types of furnaces.[4] In 1948 the country consumed over 29 million net tons of "purchased scrap" and nearly 29 million tons of "home scrap." Roughly, these amounts are equivalent to about 108 million tons of iron ore.

"Home scrap" is waste material resulting from the processing of crude iron and steel, and does not leave the steel mill. "Purchased scrap" is that scrap which is generated from the steel being processed by industry. It falls into two categories: "prompt industrial scrap," composed of stampings, clippings, borings, and other like waste from processors, which flows back immediately to the mills; and "obsolescent scrap," that which results from wear and tear. This obsolescent scrap may be an old rail too badly worn for safe use, a wrecked automobile, or any iron or steel product that has been discarded as no longer serviceable. On the average, there is a 20-year cycle between the production of these goods and their return to the steel mills as obsolescent scrap.

The proportions of scrap and pig iron consumed vary considerably with the type of furnace. In the manufacture of open-hearth steel, which constitutes approximately nine-tenths of the steel output of the United States, pig iron and scrap are generally used in about equal proportions. Within certain limits pig iron and scrap are interchangeable, the respective proportions utilized at any given time depending largely upon relative supply and price of the two materials. In the Bessemer process of steel manufacture the charge consists almost entirely of molten pig iron, whereas in the electric process it is

[3] To conform with trade usage, iron ore figures are presented in gross tons, and pig iron, steel, and coal figures in net tons, throughout this report.

[4] The 1950 Scrap Institute Yearbook of the Institute of Scrap Iron and Steel, Inc., p. 16, shows the following ratios of scrap to pig iron consumed in all types of furnaces:

[In percent]

Year	Purchased scrap	Home scrap	Total scrap	Pig iron
1936	26.3	28.4	54.7	45.3
1937	25.2	27.6	52.8	47.2
1938	25.2	28.5	53.7	46.3
1939	23.4	27.4	50.8	49.2
1940	21.5	27.6	49.1	50.9
1941	22.0	29.4	51.4	48.6
1942	22.0	28.5	50.5	49.5
1943	21.9	28.7	50.6	49.5
1944	21.2	29.0	50.2	49.8
1945	23.2	28.3	51.5	48.5
1946	24.7	27.6	52.3	47.7
1947	24.5	26.2	50.7	49.3
1948	26.1	26.9	53.0	47.0
1949	23.6	27.1	50.7	49.3

ordinarily almost 100 percent scrap. Some steel-making operations combine two or three of these processes, and are known as duplex or triplex processes.[5]

USERS OF IRON ORE

The number of industrial users of iron ore is relatively small. There are nine large-scale integrated companies whose activities extend from the production of iron ore through the operation of blast furnaces and steel mills to the fabrication and sale of finished steel products.

There are 10 smaller integrated companies whose activities roughly approximate those of the nine leading companies but which, with respect to volume of production and importance in the industry, are not comparable with the larger companies.

There are about 15 merchant pig-iron producers who consume iron ore in their blast furnaces. In the past the merchant furnaces were the great suppliers of the open market pig iron which kept the steel mills of the nonintegrated companies going. The number and capacity of these merchant furnaces, however, have been decreasing steadily during the last 30 years.

There are approximately 60 semi-integrated steel companies and over 100 nonintegrated companies. The semi-integrated companies make steel but do not produce pig iron. The nonintegrated companies do not manufacture steel but convert purchased raw steel into finished forms.

There are also about 3,000 foundries in the United States, which, like the semi-integrated steel companies, are dependent upon the market for their supplies of pig iron. Their pig iron, combined with scrap, is melted down to produce gray iron, malleable iron, and steel castings.

Although iron ore is directly consumed only by the integrated companies and the producers of merchant pig iron, a shortage of iron ore has immediate repercussions throughout the iron and steel industry. The large integrated producers of steel are normally sellers of pig iron in the open market. If they do not produce enough for both their own operations and sale in the open market, their first recourse is to withhold for their own use supplies of pig iron ordinarily destined for the market. The impact upon buyers of pig iron is immediate and direct. A shortage experienced by the users of pig iron spreads to the fabricators and consumers of finished steel products.

[5] The 1950 Scrap Institute Yearbook, p. 15, shows the following relationships for 1948:

[In percent]

Type of furnace	Home scrap	Purchased scrap	Total	Pig iron
Open-hearth	25.2	21.1	46.3	53.7
Bessemer	4.0	1.1	5.1	94.9
Electric	34.6	63.5	98.1	1.9
Cupola	31.8	35.1	66.9	33.1
Air and Brackelsberg	53.5	30.0	83.5	16.5
Puddling				100.0
Blast	49.9	50.1	100.0	
Direct castings				100.0
Ferro-alloys	3.9	96.1	100.0	
Miscellaneous	5.2	94.8	100.0	

In this chain of events the supply of scrap plays a crucial role. The integrated companies use "home scrap" in their mill operations; they are also regular bidders for "purchased scrap." When an iron ore shortage looms, the demand for scrap is intensified. In an effort to offset their lack of iron ore, the integrated companies become insistent bidders in the scrap market. Their success in obtaining scrap supplies is at the direct cost of other firms in the industry which normally depend heavily upon scrap for their operations.

Thus, in one way or another, an imbalance in the supply of iron ore affects such basic segments of the iron and steel industry as the merchant blast furnaces which produce pig iron largely for the open market; the integrated iron and steel producers with their varying proportions of control over iron ore and scrap supplies; and successively the customers of these two classes of producers of pig iron, namely, the semi-integrated steel companies and the foundries; the fabricators of steel products; and, finally, the users of steel products throughout the economy.

PART II

BACKGROUND OF DOMESTIC ORE HOLDINGS

For the last several decades the great bulk of the country's supply of iron ore has come from the Lake Superior region. This great reserve, extending through Minnesota, Michigan, Wisconsin, into parts of Canada, was first commercially exploited in the early 1860's.

Up to that time the industry had been characterized by an almost total lack of integration. Most of the iron furnaces in the United States were located near to sources of iron ore and fuel. When its sources were exhausted, a furnace would be abandoned.[1] A few of the furnaces owned their own ore supply, but the vast majority obtained their ore by purchase from independent ore-mining companies. In turn, the merchant furnaces marketed their pig iron to steel companies which were small in size, widely scattered and nonintegrated.

The first blast furnaces in this country used charcoal and later (but chiefly in eastern Pennsylvania), anthracite coal. The westward movement of the furnaces followed the development of the use of coking coals; and it was sheer good fortune that the vast reservoir of iron ore in the Lake Superior area, the richest in the country, lay adjacent, freightwise, to the supply of coking coals in Pennsylvania and West Virginia. The old beehive coke oven was eventually superseded by the byproduct oven; and with this change, the development of large-scale operations was under way.

Initially the iron-ore holdings in the Mesabi and other ranges in the Lake Superior district were widely scattered. As late as 1890 the small merchant furnaces were still marketing considerable amounts of pig iron. But by this time the drive for centralized control in the steel industry was already under way. For a brief period this control was achieved through pools and informal understandings among companies; but this soon gave way to outright consolidations. By 1892 the Carnegie Co., already partially integrated through ownership of blast furnaces and close affiliation with H. C. Frick Coke Co., had acquired a one-half interest in Oliver Iron Mining Co., lessee of a number of mines on the Mesabi Range. Integration was the aim of the organizers of Federal Steel Co. (incorporated in 1898); and the first step toward this consolidation was a decision "to combine the Minnesota Iron Co. and the Illinois Steel Co. by some method of purchase, to put those properties * * * under one ownership, one being engaged in the ore business and the other engaged in the

[1] For an account of some of the early and all but forgotten furnaces of southeastern Pennsylvania, cf. the chapter, Iron and Steel, in Henry Seidel Canby's The Brandywine. To mention but one of these furnaces, "Rebecca Furnace, as early as 1760 was operating near the east Brandywine, getting its ore from the French Creek mines. * * * But the life of iron on the Brandywine was short. * * * Soon the available wood for charcoal in the fertile valley country was exhausted, and, a little later, the more extensive forests of the barren Welsh Hills were used up. For lack of charcoal, Rebecca Furnace was closed in 1794" (op. cit., pp. 225, 229).

Joseph G. Butler, Jr., in his Recollections of Men and Events (pp. 4, 6), tells how his father left central Pennsylvania about 1838, when the iron business there was beginning to decline "on account of both ore and wood for charcoal becoming scarce," moving "from Bellefonte to Mercer County, Pa., where he and others erected a blast furnace. * * *"

manufacturing business." [2] Some of the same persons had been interested in both companies, but the merger was at least partially stimulated by Carnegie Steel Co.'s having, in the latter part of 1896, "executed a contract with the Lake Superior Consolidated Iron Mines (owned chiefly by Rockefeller interests * * *), providing for the lease, for a period of 50 years, of ore properties capable of furnishing a large annual tonnage, at a royalty of 25 cents per ton." [3]

In 1901 the formation of United States Steel Corp., bringing together 138 companies into one corporate family, epitomized the trend in the iron and steel industry. The inclusion of Federal Steel in the new merger brought its large holdings of iron ore in Minnesota (formerly the properties of Minnesota Iron Co.) into the hands of United States Steel; and the acquisition of the Carnegie Co. involved the extensive properties held by Oliver Iron Mining Co. Rockefeller's Lake Superior Consolidated Iron Mines were also included in the consolidation at what the Commissioner of Corporations considered a highly inflated valuation.[4] The acquisition of the Lake Superior company eliminated an independent marketer of ore with its own shipping facilities. Speaking of the situation with respect to the availability of ore prior to the organization of United States Steel, James Gayley told the Stanley committee:

> We used to, before that, be able to go up to the large ore holdings in Minnesota, for instance, to the Rockefeller interests, to the lumber interests there, and we could always lease an additional ore proposition, they were always available; but after the formation of the United States Steel Corporation those properties were all taken up by different people, manufacturers of steel in this country, to a very large extent by the independent steel makers * * *.[5]

In 1907 United States Steel further extended its program of acquisitions by leasing the Great Northern properties, the last large block of ore reserves in the Mesabi. The royalty rates were high, but the effect of the new acquisition was to bring most of the ore of the Mesabi within its control.[6] By this time ore holdings throughout the Lake Superior region were heavily concentrated in a few hands. United States Steel constituted the dominant interest; the remaining ore was held by a few steel companies and a small number of ore houses which had close ties with the steel makers.

This spectacular concentration of the country's richest reserves of iron ore invited the scrutiny of the famous Stanley committee in 1911.[7]

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[2] Hearings before the Committee on Investigation of United States Steel Corp., 62d Cong., 2d sess., House of Representatives. (These hearings will hereinafter be cited as Stanley committee hearings. Cf. p. 14 n. 1.), vol. 1, p. 202. Testimony of Judge Gary.

[3] Report of the Commissioner of Corporations on the Steel Industry (hereinafter to be cited as Report on the Steel Industry), pt. I (1911), p. 76.

[4] Rockefeller's purchase price for the properties was $400,000; in selling to United States Steel, he received $80,000,000 of the latter's securities, about equally divided between common and preferred stock.

[5] Stanley committee hearings, vol. 1, p. 372.

[6] Estimates of United States Steel's holdings in 1911 varied considerably; but Gary and Gayley were willing to concede ownership of at least 50 percent of the ores in the Lake Superior district. In testimony before the House Ways and Means Committee in 1908, Gary had been led to admit that United States Steel "pretty nearly" controlled the ultimate ore supply of the country, though its control was "not absolute." He believed then—so he told the Stanley committee—that "the United States Steel interests had control of something like 65 or 70 percent of the best ores in the Northwest," but was speaking without having had "opportunity to look into the figures." Oliver Iron Mining shipped 16,670,032 tons from the Mesabi Range in 1910, out of a total of about 28,000,000 tons shipped from that range (Stanley committee hearings, pp. 80, 83, 398, 405, 5523).

[7] No investigation of the iron and steel industry since that time is comparable with that of the Stanley committee. On May 4, 1911, the House of Representatives adopted a resolution (H. R. 148) setting up a "Special Committee To Investigate Violations of the Antitrust Act of 1890 and Other Acts," and specifically directing the committee "to investigate the United States Steel Corporation, its organization and operation," and to "inquire whether said steel corporation has any relations or affiliations in violation of law" with certain steel companies which were named, "or any other iron or steel company." Violations of the law which might be disclosed were to be reported. The special committee, which came to be known by the name of its chairman, the Honorable Augustus O. Stanley, called itself the Committee on Investigation of United States Steel Corp. It began its hearings, which continued for nearly a year, on May 27, 1911, and produced eight volumes of testimony and exhibits.

In the face of wide public criticism, United States Steel canceled its Great Northern leases shortly thereafter.[8] The properties were then turned over to other companies for exploitation. Leases on developed mines were granted to Butler Bros., St. Paul, and to some of the country's largest ore merchants or their affiliates—notably M. A. Hanna Co. and Cleveland-Cliffs Iron Co. Other leases went to a few of the steel companies.[9] Leases on undeveloped properties made at the same time were not announced but were believed to have been disposed of in a manner similar to that followed in the cases of developed mines.[10]

The opening of the Great Northern properties had profound consequences for the iron and steel industry. The few ore merchants which had not already succumbed to the steel companies were enabled to strengthen their ore positions by acquiring more holdings of ore-bearing lands; eventually large quantities of the ore held by these merchants drifted into the hands of integrated steel producers other than United States Steel. In large measure it has been the ore from the Great Northern properties which has permitted the development of these integrated units to compete with the country's largest steel company.

The ore merchants themselves have had an interesting history. Until late in the nineteenth century, the production of merchant mines [11] constituted the major source of iron ore in the United States. Many of these mines were owned or leased by ore houses; others employed ore companies as selling agents. Discussing "comparative lack of integration" as "a feature of the steel industry in the early nineties," the Commissioner of Corporations wrote:

> * * * the production of ore, broadly speaking, was a business by itself, and comparatively few iron and steel companies had extensive holdings of ore lands. This was especially true of the ore supplies in the lake region; in the East the ownership of ore lands by steel makers was rather more common.[12]

It was not until 1892, for example, that Carnegie Steel Co., Ltd.,[13] at its organization "the largest single unit in the industry," took "the first step in the direction of providing itself with a future supply of ore," [14] having previously "depended almost wholly for its supply of

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[8] The lease agreement had contained a provision permitting cancellation of the lease on January 1, 1915, if 2 years' previous notice had been given. No provision for cancellation after that date was included. United States Steel was required to mine and ship by the Great Northern Railway to Superior, Wis., a minimum annual tonnage, increasing from 750,000 tons in 1907 to 8,250,000 tons in 1917, at which figure it would continue during the remainder of the lease. Royalties on the specified minimum tonnages were payable even if smaller quantities were mined. The standard on which the royalties were computed was dried ore with a metallic iron content of 59 percent, and the royalty increased in each successive year by 3.4 cents per ton. "The lease as to the lands owned in fee by the Great Northern" was to continue until the steel corporation had "mined all ore containing 49 percent or over of metallic iron, and upon the exhaustion of ore of such grade the lease [was] to be extended so long as the steel corporation [desired] to mine such ore as [remained]. As to the leasehold properties (subleased * * * by the Hill interests), the term of the sublease in each case was to be the same as that in the original leases, less a period of 3 months." Royalties paid under the lease up to 1911 indicated that the ore extracted since 1907 had been running only slightly less than 59-percent iron content on a dried basis. To cease or curtail mining operations would thus only delay the day when an iron content of 49 percent would be reached and the lease expire, while in the meantime royalties would have to be paid on minimum tonnages (Report on the Steel Industry, pt. I, pp. 46–48, 260–262, 318–323). In October 1911, United States Steel gave notice that it was relinquishing the lease.

[9] Moody's Manual (Industrials), 1919, pp. 1508, 2513. M. A. Hanna organized the Hanna Ore Mining Co., in which certain steel companies took interests.

[10] Some of the later leases were made public.

[11] Cf. testimony of L. C. Hanna before the Stanley committee (Stanley committee hearings, vol. 2, p. 843): "* * * what I would call the merchant mines, mines that produce ores to sell."

[12] Report on the Steel Industry, pt. I, p. 66. Cf. ibid., pp. 66–67, for further details.

[13] Organized 1892, as a Pennsylvania limited partnership with capital stock of $25,000,000; its annual pig iron capacity was 1,200,000 tons.

[14] This was "the acquisition of a half-interest (which was later increased) in the Oliver Iron Mining Company, which at that time held leases of several important mines on the Mesabi Range. The annual supply of ore covered by this arrangement, however, was small in comparison with the Carnegie companies total requirements. Moreover, at this time Mr. Carnegie is said to have been decidedly opposed to the owner-

ore upon purchases in the open market, or upon short-time contracts with ore producers." [15]

"Some of the iron and steel companies had acquired interests by [1899] in iron-ore mines; but to a large extent the producers of iron and steel relied for their supplies through purchases on the market"—so Elton Hoyt II, of Pickands Mather, told the Temporary National Economic Committee.[16] But before the middle of the next century this situation had radically changed. In 1948 the ore merchants in their dual capacity of merchants and managing agents for mining companies, were shippers of only about one-third of the country's entire production of iron ore, and were sellers of approximately one-seventh of the total tonnage of ore.[17]

Another important change in the status of the ore houses has been their close relation to the steel companies. In some cases the ore houses lacked the essential capital to engage in large-scale exploitation of ore properties and approached the steel companies with a partnership offer in return for the necessary capital.[18] In other cases the impetus for a closer relationship between ore merchant and steel company came from the latter. The steel company, in its desire to assure itself of adequate iron-ore supplies, either bought directly into

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ship of ore mines, and instead he preferred to let others assume the heavy speculative risks which then attended iron-mining enterprises. About 1896 the company completely reversed its policy in this respect. This change of policy * * * undoubtedly had considerable effect in directing the later course of events in the iron and steel industry as a whole." While it was "not intended to say that this change in the policy of the Carnegie Steel Company (Ltd.) was a principal cause of consolidation in the steel industry," the Commissioner of Corporations considered that "a specific influence which hastened outright consolidation in the steel industry was a radical change on the part of the Carnegie interests in their attitude toward ownership of ore reserves" (Report on the Steel Industry, pt. I, pp. 68, 76-78).

[15] Report on the Steel Industry, pt. I, p. 68.

[16] Investigation of Concentration of Economic Power, Temporary National Economic Committee, hearings pursuant to Public Res. No. 113, 75th Cong., pt. 18, p. 10221. (These hearings will hereinafter be cited as TNEC hearings.) For further discussion by Hoyt of steel companies' acquisitions of mines and mining interests, cf. ibid., pp. 10221, 10223, 10228.

[17] Cf. with respect to the distribution of ownership of Lake Superior ore some 10 years earlier, the following testimony of Elton Hoyt II before the Temporary National Economic Committee in November 1939 (TNEC hearings, pt. 18, p. 10223):

"It is estimated that the United States Steel Corporation, through the Oliver Iron Mining Co., and other subsidiaries, owns in the neighborhood of 50 percent of the Lake Superior iron-ore reserves and while exact percentages are not available, I would estimate that other integrated steel companies own by direct leases, or through ownership in mining companies, in the neighborhood of two-thirds of the balance, the remaining one-third owned by fee owners or merchant producers who are not producers of steel.

* * * * * * *

"* * * exact figures are not available, but it is generally recognized that in a normal year about 85 percent of the ore produced from the Lake Superior district is shipped directly to users who have a direct ownership in the mines and in years when operations of the steel industry are curtailed this percentage is even larger."

[18] If not at the beginning, at any rate soon after the organization of the Hanna Ore Mining Co. (organized by M. A. Hanna & Co. to obtain some of the developed Great Northern properties after United States Steel relinquished its lease), steel companies held stock interests in the company. It is not known, however, on whose initiative Hanna and the steel companies joined in this enterprise.

Whether or not Pickands Mather obtained leases from Great Northern, it is impossible to say. If so these leases were not comparable in importance to those made to Cleveland-Cliffs and Hanna. But before United States Steel terminated the Great Northern leases, Pickands Mather appears to have been in a stronger position on the Mesabi Range than the other independent ore companies. In 1917 it had undeveloped ore properties both on the Mesabi and in Michigan. About that time or possibly a year or two earlier, Pickands Mather embarked upon a course which thereafter it largely pursued—that of obtaining steel companies as partners in the development of mining properties. The reasons for this course and its consequences in terms of the later relationships of Pickands Mather were thus explained to the Temporary National Economic Committee:

"* * * back in say '15 or '16, back in about that time, we invited two or three steel companies to come into partnership with us in mines, specifically the Bennett and the Plymouth mines. Those mines were too big, we felt, for us to undertake, purely as producers and sellers of ore. They involved very large amounts of stripping and development, and it meant too big a production for us to be sure of a market, so at that time we proposed to five or six of these companies that they join with us in this mine and on that basis they agreed that we should operate that mine for its duration, or unless the company voluntarily surrendered it.

"Then we went on from there—of course, prior to this time we were connected with a number of these other steel companies where we brought the mines to them and built up the organization, and they continued to have us operate them. Well, then in later days as these steel companies have become merged in many instances, the mines that were formerly in the hands of three or four companies became in one company and that one company therefore, had a large interest in this property which either was tied up to us by contract or was only tied up for a short period of time. That is the way the picture grew" (TNEC hearings, pt. 18, p. 10228).

the properties held by the ore houses or acquired such properties as are incident to a merger.[19]

The large steel companies and the ore houses have increasingly become more closely allied. At the present time large amounts of ore are obtained by the steel companies through ownership arrangements in mines managed and operated by the ore houses.[20] In consequence, less and less ore produced by the ore houses has entered the open market. In a very real sense such ore is captive to the steel companies.

Before discussing the sources of ore for the country's largest steel companies, brief accounts are given of how these companies acquired their more important domestic ore holdings—in particular those obtained through absorption or merger of other steel companies.

UNITED STATES STEEL CORP.

United States Steel Corp., a holding company, was incorporated in New Jersey on February 25, 1901. It was a combination of combinations which, within a few months of its rather hurried formation,[21] had brought under one management 138 companies, embraced in 12 holding corporations, to make the largest steel company in the world. The merger was accomplished through the acquisition by United States Steel of virtually all the capital stock of the following companies:

Carnegie Co.
Federal Steel Co.
National Steel Co.[22]
American Steel & Wire Co. (New Jersey)
National Tube Co.
American Steel Hoop Co.
American Sheet Steel Co.
American Tin Plate Co.
American Bridge Co.
Lake Superior Consolidated Iron Mines
Shelby Steel Tube Co.

Also acquired were the entire issue of bonds of Carnegie Co. and that part of the capital stock of Oliver Iron Mining Co. and of Pittsburgh Steamship Co. (a one-sixth interest in each case) not already owned by Carnegie Co.[23]

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[19] E. g., when Bethlehem acquired Midvale, it obtained that company's one-ninth stock ownership in Bennett Mining Co. and its 15-percent stock ownership in Plymouth Mining Co., both mining companies into which steel manufacturers had been invited by Pickands Mather.

[20] Pickands Mather & Co. reported to the Commission that it acts as manager and sales agent for mining companies under agreements with the mining companies and their stockholders which "provides, among other things, for the manager overseeing and supervising the operations of the mining companies, keeping the books of account and records, filing tax returns, carrying out the obligations of the Companies under their leases, supervising shipments and transportation of the ores, furnishing periodic reports to stockholders and acting as sales agent for any ore not taken by the stockholders. As compensation for such services the Manager is reimbursed for certain expenses incurred and receives a commission based upon tonnage produced and shipped." In general, the functions herein described are typical of those of the managing agent of iron-ore mines.

[21] Report on the Steel Industry, pt. I, p. xix: "With amazing swiftness, in a few weeks, the United States Steel Corporation was * * * organized, and began business on April 1, 1901."

[22] Not to be confused with the present National Steel Corp. (incorporated 1929), in which were merged Weirton Steel Co., Great Lakes Steel Corp., and Hanna Iron Ore Co.

[23] The underwriting agreement of April 1, 1901, between J. P. Morgan & Co. and United States Steel Corp., in accordance with which Morgan was to acquire the stocks of certain corporations which, it was said, "the board of directors of the Steel Company deem it necessary for its business now to acquire," provided for the purchase of the stocks of The Lake Superior Consolidated Iron Mines and the affiliated (i. e., also Rockefeller-owned) Bessemer Steamship Co., owning the leading fleet of ore carriers on the Great Lakes, of American Bridge Co., and of the shares (a one-sixth interest in each case) of Oliver Iron Mining Co. and Pittsburgh Steamship Co. not owned by Carnegie Co. at the organization of United States Steel. Morgan was authorized and requested to obtain, in exchange for steel company stock, the outstanding shares of

Acquisitions of ore properties

Each of the steel companies included in the merger was itself the result of consolidation. Carnegie, Federal, and National Steel were producers of iron and steel and heavy steel products, and were major suppliers of crude and semifinished steel to the manufacturers of finished products. All three companies were integrated backward to raw materials, iron ore, and coal, and owned at least some transportation facilities. The Carnegie Co., though by far the largest, had, to a greater extent than any of the other merged steel companies, achieved its size by internal growth. Federal, incorporated in September 1898, was a realization of "Judge Gary's vision of * * * an enlarged and more self-contained Illinois Steel Co." [24] It brought together Illinois Steel, the competing Lorain Steel Co., and Johnson Co. (Pennsylvania); Minnesota Iron Co. (one of the largest ore companies in the Lake Superior region and the owner of an ore railroad and a fleet of ore vessels), and Elgin, Joliet & Eastern Railway. J. P. Morgan helped make Judge Gary's dream come true.[25]

National Steel Co., organized in February 1899, was essentially a consolidation of competing producers of crude and semifinished steel. One of its constituent companies, however, had a one-fourth interest in a lease of a mine on the Mesabi Range; and soon after its incorporation the new company acquired the Chapin and Winthrop mines, and with them nine ore steamers, also acquiring furnace and coke properties. Further, it entered into a 20-year contract for a one-sixth interest in the ore production of Oliver Iron Mining Co.[26] "Thus, at the outset, the company adopted a vigorous policy of integration. In fact, integration was carried by this company to a point which fairly put it in the same general class with the Carnegie Co. and the Federal Steel Co." [27]

Lake Superior Consolidated Iron Mines (owned principally by Rockefeller interests) was not engaged in the steel business; but it had close connections with the Carnegie Co. In 1896 Carnegie Steel Co. (Ltd.), which had been taken over by the Carnegie Co. of New Jersey upon its incorporation in 1900, had "executed a contract with the Lake Superior Consolidated Iron Mines * * *, providing for the lease, for a period of 50 years, of properties capable of furnishing a large annual tonnage, at a royalty of 25 cents per ton. An important feature of the contract was that the transportation of this ore was to be over the Duluth, Missabe and Northern Railway (the stock of which

Colorado Fuel & Iron Co. stock. In exchange for Colorado's 20,000 shares of preferred and 170,000 shares of common stock, the aggregate par values of which were respectively $2,000,000 and $17,000,000, United States Steel was willing to issue not to exceed $15,000,000 of its preferred and $15,000,000 of its common stock. According to the Commissioner of Corporations, "negotiations * * * were entered into * * * for the acquisition of" Colorado Fuel & Iron, "but were not consummated." Further particulars concerning the attempted acquisition are lacking.

"The Colorado Fuel & Iron Company was organized in 1892 * * * as a merger of the Colorado Fuel Company and the Colorado Coal and Iron Co. It was chiefly interested in the operation of coal properties, although the Colorado Coal & Iron Company, one of the constituent concerns, had iron ore lands and a small steel plant." But "in 1899 the company greatly expanded its operations by the construction of a new Bessemer steel plant, open hearth steel works, and finishing mills for the production of a large variety of steel products. At this time its authorized capital stock was increased from $13,000,000 to $25,000,000."

(Report on the Steel Industry, pt. I, pp. 13, 64–65, 96–97, 386–390 (exhibit 2, Underwriting Agreement of April 1, 1901, between J. P. Morgan & Co. and the United States Steel Corp.).)

[24] Irving S. Olds, Judge Elbert H. Gary (1846–1927)—His Life and Influence Upon American Industry, p. 12.

[25] J. P. Morgan & Co. headed the syndicate which promoted the consolidation. "The large residue of stock left in the hands of the syndicate—amounting to $5,680,565 preferred and $8,422,992 common—less the amount of cash ($4,823,373) provided by the syndicate on its own account, constituted the compensation of the syndicate" (Report on the Steel Industry, pt. I, p. 126).

[26] National obtained no interest in Oliver Iron Mining Co.'s stock, five-sixths of which was held by the Carnegie Co.

[27] Report on the Steel Industry, pt. I, p. 90.

was held by the Lake Superior Consolidated Iron Mines), and down the Lakes in the vessels of the Bessemer Steamship Co., which was also a Rockefeller concern." [28]

This last company was acquired at the same time as the mining company and its railroad. As Fortune put it, "* * * the twin foundation pillars of the edifice" known as United States Steel were "the Carnegie Co. * * * and the great Mesabi ore holdings, which Rockefeller had squeezed from the Merritt brothers in foreclosing a $420,000 loan." [29]

Many of the constituent companies of American Steel & Wire Co. (New Jersey), up to the date of their union in 1899, had been mainly dependent upon the large steel producers for their raw materials; and none was self-sufficient, though some brought to the new company facilities for the production of pig iron and crude steel. Expansion of these facilities was undertaken almost immediately following the organization of American Steel & Wire; and the steps toward further integration which were soon begun included the purchase of coal and iron ore properties.[30]

American Steel Hoop Co., one of the less important of the companies combined in United States Steel, was to some extent integrated at its organization in April 1899, i. e., it had blast furnaces and rolling mills. "Shortly after its organization the company strengthened its position by the acquisition of important ore and coke supplies." When it became part of United States Steel, it owned 20 percent of the stock of Mahoning Ore & Steel Co. and 50 percent of the stock of Union Ore Co.[31]

Toward the end of November 1902, United States Steel Corp. purchased Union Steel Co., which had come into being less than a month earlier as the result of a merger of an earlier Union Steel Co. and Sharon Steel Co. Both were well integrated companies with ore reserves; and the tonnage acquired through its Union Steel Co. purchase was estimated by United States Steel in its annual report for 1902 as "approximately 40,000,000 tons." [32]

By its purchase of Clairton Steel Co. in 1904, United States Steel Corp. acquired Clairton's St. Clair iron mine and its lease of the Little & Prindle mine. Both mines were on the Mesabi Range. Their estimated deposits were, respectively, about 4,000,000 and 3,500,000 tons. Clairton's holdings on the Marquette Range, consisting of 20,000 acres owned in fee, were obtained in the same transaction.[33]

Unified management of all United States Steel ore properties was arranged in 1904, when they were put under the control of Oliver Iron Mining Co.[34] The identity of individual mines thus largely disappeared.[35]

In August 1903 the corporation leased the holdings of Chemung Iron Co., which were on the Mesabi Range. "The ore deposit was

[28] Report on the Steel Industry, pt. I, pp. 76–77.
[29] Op. cit., March 1936 ("U. S. Steel: I"), p. 65.
[30] In 1900 the company acquired American Steamship Co., operating 12 vessels on the Great Lakes
[31] Report on the Steel Industry, pt. I, p. 91, and table 3 (facing p. 107).
[32] Ibid., p. 214.
[33] Ibid., p. 255.
[34] Ibid., p. 275.
[35] In the first few years after its organization, United States Steel was active not only in absorbing other steel companies but also in acquiring desirable ore properties which it could obtain directly. The minutes of the finance committee of United States Steel for February 4, 1902, record authorization of a payment of "$200,000 to Samuel Mather, of Cleveland, for his services in the purchase of the Arragon [sic] Mine for the National Tube Co." (Stanley committee hearings, vol. 6, p. 3847.)

estimated to amount to as much as 70,000,000 tons, mostly of Bessemer grade." [36]

In 1904 the corporation acquired the Arcturus mine "at a royalty of 25 cents per ton plus a bonus of $100,000. The ore from this mine [was] sandy and [had] to be washed before shipment. The tract was a large one, with an estimated ore body of upward of 12,000,000 tons * * *." [37]

The year following, the ore holdings of Canisteo Mining Co., covering nearly 500 acres in Itasca County, Minn., were leased. This deposit, the ore in which required concentration, "was estimated at over 100,000,000 tons"; but by 1911 the estimate had "been considerably increased. * * * In addition to the royalty the Steel Corporation paid a bonus of $500,000 in cash." [38]

At the height of the financial panic of 1907, United States Steel Corp. purchased the stock of Tennessee Coal, Iron & Railroad Co. This was originally a coal company, and had operated as such for nearly 30 years prior to its entering the iron business and changing its name in 1881. By the early nineties it had acquired several coal and iron companies having valuable properties. During the earlier years of its expansion the company manufactured pig iron, but after 1898 it was also a producer of steel. Though unquestionably the leading steel company in the South, "the most important assets of the Tennessee concern * * * were," according to the Commissioner of Corporations, "its enormous holdings of ore and coal." [39] The ore reserves had been estimated in 1906 at 700,000,000 tons. Agents of United States Steel later estimated the total tonnage as 697,350,000 tons, including 239,000,000 tons of "red ore of lower grade but which may be of future value" and 3,150,000 tons (probable tonnage) of brown ores.[40] Judge Gary in his testimony before the Stanley committee characterized Tennessee Coal, Iron & Railroad Co.'s deposits as of "an inferior grade * * * and not of very great value * * *. You could hardly," he added, "consider that in connection with the Lake Superior ores, so-called, or as adding to the Lake Superior ores." [41] The annual report of United States Steel Corp. for 1907 did, however, call "the Tennessee property * * * very valuable," stating in the next sentence, "Its mineral resources are large." [42]

From 1899 to 1906 Great Northern Railway, and J. J. Hill acting for the Great Northern system, had been acquiring ore lands in the Lake Superior region, and by 1906 had accumulated more than 65,000 acres. A subsidiary of Great Northern, Eastern Railway of Minnesota, owned "the so-called Wright & Davis ore property in St. Louis and Itasca Counties, Minn." (described as "the nucleus of the ore holdings of the Great Northern system"), which "included also a lumber railroad—the Duluth, Mississippi and Northern—which had extensions to the mining properties discovered on this tract." In January 1907 approximately 40,000 acres of the Great Northern ore lands were leased to Great Western Mining Co., a subsidiary of United

[36] Report on the Steel Industry, pt. I, p. 259.
[37] Ibid., pp. 259–260.
[38] Ibid., p. 259.
[39] Ibid., p. 256.
[40] Ibid., p. 257.
[41] Stanley committee hearings, vol. 1, p. 125.
[42] Ibid., p. 146. Some 30 years after its acquisition by United States Steel, Tennessee Coal, Iron & Railroad Co. which since 1907 had been a half owner of Potter Ore Co. purchased the remaining 50 percent of its capital stock from Republic Steel Corp. on January 1, 1937.

States Steel. "By this transaction the Steel Corporation acquired control of ore reserves generally estimated from 400,000,000 to 500,000,000 tons, while more liberal estimates were nearly double these figures." The corporation guaranteed performance of the stipulations of the lease.[43]

The terms of the lease, the conditions of which the Commissioner of Corporations more than once referred to as "onerous," will not be set forth in detail; but it may be noted that the "royalties were unprecedented"; that the minimum tonnage required to be mined, and it increased progressively, for 10 years, was very high; and that Great Western Mining Co. agreed to ship all ore over Great Northern Railway to the port of Superior, Wis. The lessee did, however, have the right to cancel the lease on January 1, 1915, 2 years' previous notice having been given.[44]

Dealing with "the question * * * as to why the Steel Corporation entered into this lease under the onerous conditions noted," the Commissioner of Corporations wrote:

> The only reasonable explanation which the Bureau has found for this unusual transaction is that it was designed to prevent this ore from falling into the hands of competitors of the Corporation * * *. By securing control of these enormous reserves the Steel Corporation obviously strengthened its control of the ore industry and at the same time put substantial obstacles in the way of further competition in the iron and steel industry.[45]

The lease was, however, canceled, notice being given in 1911, the year of the Commissioner of Corporations' Report on the Steel Industry, of the Stanley hearings, and of the filing of an antitrust suit against United States Steel Corp. all of which obtained considerable newspaper publicity. "With public opinion what it was at the time," wrote Fortune in 1936, "Gary had no choice but to give up the Hill lease * * *. Thus the Corporation was forced to abandon its original conception, which was nothing less than to corner the ore supply of the Nation." [46] To Mr. Hill's mind such a conception would apparently have been sound, whatever the actual intentions of the corporation. "I think it was a fair and no more than ordinary business prudence on their part to secure the absolute control of all the ore they could get," so he told the Stanley committee in February 1912. "I speak of that, of all the ore of that class, because it is limited * * *. Why, upon that ore depends their existence." He could suggest no reason why United States Steel should have canceled its Great Northern ore contract, though he would express an opinion: "I think they were frightened to death * * *. They had buck fever." [47]

Almost two decades passed before United States Steel obtained any other ore properties. Early in 1930 United States Steel acquired the assets, properties, and business of Columbia Steel Corp., which "owned and operated steel-producing plants and rolling mills at Pittsburg and Torrance, Calif.; a steel foundry at Portland, Oreg.; and a blast furnace and byproduct coke plant at Provo, Utah. It also owned extensive iron ore, coal, and limestone deposits in Utah." [48] Besides its own properties, largely undeveloped in 1930, Columbia

[43] Report on the Steel Industry, pt. I, pp. 260-261.
[44] Ibid., pp. 261-262, 319-322.
[45] Ibid., p. 322.
[46] Op. cit., March 1936, p. 158.
[47] Stanley committee hearings, vol. 4, pp. 3203-3204.
[48] Report of the Federal Trade Commission on the Merger Movement, p. 76.

had the right to operate on a royalty basis certain ore properties adjoining its holdings.[49]

When Geneva Steel Co. was organized in 1943, United States Steel's western subsidiary built the $180,000,000 steel plant for Defense Plants Corporation, under contract with which Columbia Steel subsequently operated the plant without fee or commission. The plant was purchased by United States Steel in June 1946.

BETHLEHEM STEEL CORP.

Bethlehem Steel Corp. (New Jersey), incorporated on December 10, 1904, and three of its wholly owned subsidiaries (including Bethlehem Mines Corp.) were consolidated with Bethlehem Steel Corp. (Delaware), the present holding company, in 1936. This holding company was incorporated under the laws of the State of Delaware in July 1919.

The older holding company, Bethlehem Steel Corp. (New Jersey), was the successor, under a so-called "modified plan" of reorganization (a compromise) [50] of United States Shipbuilding Co., another holding company which had been put together in 1902. The former was promoted as a horizontal combination of small shipbuilding companies by which, it was claimed, important economies would be effected and consequently greater profits accrue. The inclusion of Bethlehem Steel Co., which had for some years been specializing in ordnance rather than commercial work and could supply plates for the ships to be built, represented backward vertical integration. But although the idea of acquiring Bethlehem Steel seems to have been in the nature of an afterthought,[51] the terms upon which it was obtained "amounted to the surrender of the shipbuilding yards to the control of the Bethlehem Steel Company." [52]

Bethlehem Steel Co. had been organized under Pennsylvania laws in 1899 to lease Bethlehem Iron Co. at South Bethlehem, Pa., where a predecessor company had been established as early as 1857 and Bethlehem Iron Co. had been operating a large plant for some 20 years. Title to the assets of Bethlehem Iron Co. was acquired by Bethlehem Steel Co. in 1901; the older company ceased to exist; and J. P. Morgan & Co., as head of United States Steel's underwriting syndicate, acquired from Charles M. Schwab the stock of Bethlehem Steel Co. All these transactions occurred at approximately the same time—about 2 months after Schwab had obtained the Bethlehem Steel Co. stock. Early in July 1902, Schwab contracted to buy back from J. P. Morgan & Co. the Bethlehem stock, and "then agreed to turn the stock over to the Shipbuilding Company, for $10,000,000 Collateral

[49] Moody's Manual (Industrials), 1930, p. 135.

[50] For details regarding the "modified plan," cf. Moody's Manual, 1904, p. 1612, ff., and Arthur S. Dewing, Corporate Promotions and Reorganizations (chs. XVII and XVIII), upon which the ensuing paragraphs devoted to United States Shipbuilding Co. are largely dependent.

[51] An earlier but unsuccessful attempt at consolidation of shipyards, in which had been active some of the same men who promoted United States Shipbuilding Co., had contemplated only a consolidation of shipyards. Nor did the plans for United States Shipbuilding provide for the acquisition of a steel manufacturing company. When Charles M. Schwab, as a member of the underwriting syndicate, subscribed to $500,000 of the bonds of the projected shipbuilding consolidation, he was still president of United States Steel. He "later testified that his chief interest in the shipbuilding combination lay in the fact that it would be a large customer of the Steel Corporation" (Dewing, op. cit., p. 484, note 2). Three days before the prospectus was issued and while it was in the course of being printed, Schwab, casually encountering two of the men influential in organizing United States Shipbuilding, said (according to the testimony of one of them), "Why don't you buy the Bethlehem plant?" (Dewing, op. cit., p. 484). This question by the president of United States Steel led, by a somewhat tortuous course of events, to the incorporation, about 2½ years later, of Bethlehem Steel Corp. (New Jersey).

[52] Dewing, op. cit., p. 487.

Trust bonds, * * * and $10,000,000 in each of the two classes of stock," both preferred and common being essentially bonus.[53]

Bethlehem Steel Co. was acquired by United States Shipbuilding Co. on August 12, 1902. Under the separate management which Bethlehem retained, this subsidiary, "although loaded down with fixed charges, * * * was able to show a net profit of over $1,500,000 during the first year." [54] It was, in fact, the only profitable subsidiary, and its directors were not disposed to part with its earnings, in spite of the acute distress of the parent company.[55] A receiver for United States Shipbuilding Co. was appointed on July 1, 1903. After more than a year of negotiations, generally unfavorable publicity, and litigation (which did not end with the reorganization), Bethlehem Steel Corp. (New Jersey) came into being. "In a true sense," commented Dewing, "the reorganization was merely a second step in the promotion." [56]

In the new corporation there could be no doubt that the preeminent position belonged to Bethlehem Steel Co. and that the shipbuilding companies were subordinate, or, as Fortune termed them, "appendages." [57] With Charles M. Schwab (who had parted company with Judge Gary and left the presidency of United States Steel) as both president and chairman of the board of Bethlehem, there was unified authority. But, except for the Juaragua iron mines which Bethlehem Steel Co. had purchased in Cuba while it was a subsidiary of United States Shipbuilding Co., Bethlehem Steel Corp. was no more integrated than its predecessor had been at its organization.

Acquisitions of ore properties

As late as 1911, Bethlehem had no significant holdings of domestic ore, [58] though the sanguine Schwab [59] estimated his company's Cuban reserves as adequate for some two and a half centuries.[60] The next year, however, "he went to France and closed what was overwhelmingly the biggest deal in the company's history. From the Schneider interests he bought the Tofo Iron Mines in Chile, containing 50 million tons of ore with iron content about 10 percent better than Superior ores." [61]

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[53] Ibid., pp. 485–486.

[54] Ibid., p. 499.

[55] Cf. Dewing, op. cit., p. 499: "Had the Directors been willing to release some of their earnings to the parent company, it could have met its interest on the first mortgage bonds. The Board of Directors, who were under the control of Charles M. Schwab, voted instead only $250,000 to the shipbuilding company—just enough to meet the semiannual interest payment on the Collateral Trust bonds issued for the purchase of the Bethlehem works. The rest of the earnings were deflected to the purchase of iron mines, to the accumulation of inventoried merchandise, and to the general improvement of the plant."

[56] Op. cit., p. 509.

[57] Fortune, August 1945 ("Bethlehem Ship"), p. 125.

[58] In 1909 it had acquired a 51.6-percent interest in Cheever Iron Ore Co., Port Henry, N. Y. At least one of the members of the Stanley committee found it hard to believe that Bethlehem was without ore holdings in the Great Lakes region, as the following colloquy indicates:

"Mr. BEALL. Your company owns extensive ore holdings in this particular region [Minnesota]?

"Mr. SCHWAB. None whatever.

"Mr. BEALL. None in this particular region?

"Mr. SCHWAB. None whatever.

"Mr. BEALL. In the Wisconsin region?

"Mr. SCHWAB. None, whatever, in the Northwest.

"Mr. BEALL. None in the Northwest?

"Mr. SCHWAB. No." (Stanley committee hearings, vol. 2, p. 1342).

[59] In the course of remarks at a testimonial dinner given by members of the steel industry to Judge Gary in 1909, Schwab referred to his own "bounding enthusiasm and optimism" (quoted by Irving S. Olds, op. cit., p. 16).

[60] Said Schwab:

"* * * speaking for my company and for the Pennsylvania Steel Co., there was in recent years discovered in Cuba very large deposits of ore. These two companies, valuing the future of this ore very highly, own a sufficient supply of ore there to run us 250 years. So that we do not need to feel that the industry of this country is going to be solely in the hands of a few people who own great bodies of ore.

* * * * * * * *

"* * * in my opinion there is more ore known in Cuba today than is at present developed in the entire Mesabi Range" (Stanley committee hearings, vol. 2, pp. 1292–1293, 1333).

[61] Fortune, April 1941 ("Bethlehem Steel"), p. 68.

With the acquisition in 1916 of Pennsylvania Steel Co.,[62] which, since its reorganization in 1901 had been controlled by Pennsylvania Railroad, Bethlehem obtained not only plants at Steelton, Pa., and Sparrows Point, Md., but additional ore property in Cuba and a majority interest[63] in Cornwall Ore Banks, at Cornwall, Pa., near Harrisburg. The Cornwall deposits, while favorably located and a valuable asset, were nevertheless hardly extensive, and they had been worked for many years.[64] Not long after the end of World War I, the end of the Cuban ores—with the exception of those having specialized uses—appeared to be in sight, or at any rate to be the subject of some misgivings.[65] To utilize existing steelmaking capacity, much more iron ore was required than the company could obtain from the properties it owned or leased. But all domestic reserves of any consequence were in other hands, the Hill properties, made available when United States Steel canceled its leases, having been acquired by competitors while Bethlehem apparently felt secure with its Cuban and Chilean holdings.

It was in these circumstances that Bethlehem proceeded to make provision for supplies of ore. Through one of its subsidiaries, Bethlehem acquired on October 10, 1922, all of the properties and assets of the Lackawanna Steel Co.,[66] including its various ore holdings. Lackawanna was said in 1911 to have "extensive holdings of ore and coal property,"[67] and at least three witnesses before the Stanley

[62] Pennsylvania Steel Co. was organized in 1866 and had its plant at Steelton. A subsidiary, Maryland Steel Co., organized in 1887, built a plant at Sparrows Point. "The parent company was involved in difficulties in the depression of the early nineties and was reorganized in 1895 with a capital stock of $6,500,000." The reorganization of 1901 was "under New Jersey laws with an authorized capital of $50,000,000 of which $16,500,000 preferred and $10,750,000 common stock were issued". (Report on the Steel Industry, pt. I, pp. 64, 96). Judge Gary, testifying before the Stanley committee in 1911, mentioned Pennsylvania Steel Co., along with Cambria, Lackawanna, Bethlehem, and Colorado Fuel & Iron, as one of United States Steel's "principal independent competitors who make steel rails" (Stanley committee hearings, vol. 1, p. 193.)

[63] A 54.17 percent undivided interest. This interest was increased the next year, when Bethlehem purchased the Lebanon, Pa., properties of Lackawanna Iron & Steel Co. (a small subsidiary of Lackawanna Steel Co.), which included a 16.28 percent undivided interest in Cornwall Ore Banks. Through lease of the properties of Cornwall Iron Co., Cornwall, Pa., Bethlehem controlled by the end of 1917 an additional 9.77 percent undivided interest in Cornwall Ore Banks. This interest, along with the outstanding capital stock of Cornwall Iron Co. not previously acquired, was purchased in 1919. Cornwall Ore Banks Corp. was incorporated in Pennsylvania in December 1921 and thereafter was listed as a Bethlehem subsidiary (Bethlehem Steel Corp., Annual Reports for 1916, 1917, 1918, 1919; Listing Statements of the New York Stock Exchange, A–5585, Bethlehem Steel Corp., January 19, 1922).

[64] A listing statement dated January 19, 1922 (Listing Statements of the New York Stock Exchange, A–5585, Bethlehem Steel Corp.), stated: "Cornwall Ore Banks * * * are estimated to contain approximately 30,000,000 tons of ore of about 44 percent iron; concentration and nodulization increase the iron content to about 60 percent." According to Steel Facts, August 1951 (No. 109), p. 8, "the famous Cornwall iron ores have been mined continuously for more than 200 years, the longest record of operations in the country."

[65] The Cuban properties of Bethlehem supplied 1,700 tons of iron ore in 1948. In 1947 they supplied 97,000 tons of direct-shipping ore containing an average Fe content of 39.5 percent. In its questionnaire to the Commission, Bethlehem stated that the Cuban mineral, classified as limonite, has an average Fe content of 36 percent but contains deleterious quantities of Ni, Cr, and Al_2O_3. The company stated:

"During the year 1949 experimental work by Bethlehem Steel Co. was continued in the search for a practical method to produce a usable metallurgical grade of iron ore from that mineral. The work is a continuation of years of study by the staff of Bethlehem Steel Company, coordinated with the research of many university and other laboratories. Results have not been obtained to date which permit the classification of this mineral as suitable for commercial use."

[66] Lackawanna Steel Co. of New York had in 1902 succeeded Lackawanna Iron & Steel Co. (Pennsylvania), of which it was an expansion. Lackawanna Iron & Steel Co. had been organized in 1891 "as a merger of the Lackawanna Iron and Coal Company and the Scranton Steel Co. The former concern had been incorporated in 1853 to operate coal mines and manufacture pig iron at Lebanon, Pa., and had erected a Bessemer steel plant in 1875. The Scranton Steel Co. was organized in 1881 as a competitor." "The Lackawanna Iron and Steel Company in the latter part of 1899 determined to build a large plant on Lake Erie, near Buffalo, and in December of that year increased its capital stock from $3,750,000 to $25,000,000" (Report on the Steel Industry, pt. I, pp. 64, 96). The Scranton plant was later abandoned. Bethlehem had, however, begun its relationship with Pickands Mather, having acquired an interest (apparently one-ninth) in Bennett Mining Co., organized by Pickands Mather in 1917. Moody's Manual (Industrials), 1919 (p. 913) mentions Bethlehem among the "companies interested" in Bennett, and shows one of Bethlehem's directors to have been a director of Bennett. President of the mining company was H. G. Dalton, a Pickands Mather partner, who was also a director and member of the executive committee of Lackawanna Steel, as he continued to be up to the date of Lackawanna's acquisition by Bethlehem (see p. 18). Within less than a month thereafter he was elected a director of Bethlehem.

[67] Report on the Steel Industry, pt. I, p. 96.

committee testified regarding Lackawanna's ore resources.[68] At approximately the time of Lackawanna's acquisition by Bethlehem, "the shares of ore and mining companies owned by the combined Lackawanna companies" were reported to "represent the ownership or control of more than 50,000,000 tons of iron ore," including deposits in New York near Lake Champlain, and on the Gogebic, Menominee, and Mesabi Ranges.[69]

But Bethlehem's most important achievement in the way of simultaneous horizontal and backward vertical integration occurred in March of the year following its purchase of Lackawanna, when "various Bethlehem Steel Corp. subsidiaries acquired all the properties and assets of Midvale Steel & Ordnance Co., except its Nicetown plant and ordnance business and the capital stock of Cambria Steel Co. and two other subsidiaries; they also acquired the properties and assets of Cambria Steel Co. Midvale Steel & Ordnance Co. owned approximately 97 percent of Cambria Steel Co.'s capital stock, and was engaged in the manufacture of iron and steel products. Cambria Steel Co. operated (under a 999-year lease dated December 1, 1898) the plant of Cambria Iron Co. at Johnstown, Pa." [70]

In the Report on the Steel Industry, Cambria Steel Co.'s ore was conservatively said to be "chiefly derived from the lake region where it has important reserves." [71] Testimony before the Stanley committee brought out with particularity the importance of Cambria's holdings. Mention was made of Cambria properties on the Marquette, Menominee, and Gogebic Ranges.[72] It was, however, as holder of a half interest in the Mahoning Ore & Steel Co. that Cambria occupied its prominent and enviable position among the independent steel companies with ore reserves.[73] James J. Hill, testifying before the Stanley committee in February 1912, expressed the opinion that the Mahoning mine was "the largest mine probably on the [Mesabi] range," [74] and declared it worth all he paid for it. "I think the lease that the Mahoning Co. owns," he said, "is worth anywhere from $50,000,000 to $75,000,000." [75] Joseph Sellwood, a mining expert called by the Stanley committee, who testified that he had "helped to open every range except the Marquette Range," [76] said of Cambria: "* * * they control considerable ore. I would say, offhand, they control about 100,000,000 tons of ore in the Lake Superior district." [77]

[68] John W. Gates, testifying as to Lackawanna's supply of ore, said, "They own the Brotherton and half a dozen other mines." Judge Gary named Lackwanna as one of the "independent steel makers, so-called," having "large holdings" on the Mesabi Range. James J. Hill mentioned Lackawanna as one of the steel companies owning Lake Superior ore properties, and seemed to think that, leaving out United States Steel, Lackawanna was among the three steel companies having the largest holdings (Stanley committee hearings, vol. 1, pp. 53, 89, vol. 4, pp. 3181, 3236).

[69] Poor's and Moody's Manual Consolidated, 1922, industrial section, vol. II, p. 728.

[70] Report of the Federal Trade Commission on the Merger Movement, p. 86.

[71] Op. cit., pt. I, p. 96.

[72] Stanley committee hearings, vol. 1, pp. 394–395; vol. 7, p. 5417.

[73] Bethlehem acquired control of Mahoning with the purchase of an additional 1-percent interest in 1929.

[74] Stanley committee hearings, vol. 4, p. 3155.

[75] It was, in fact, on the strength of the Mahoning mine that Hill bought the Wright & Davis property, consisting of approximately 25,000 acres. At the time the purchase was made, the only mine in operation on the entire 25,000-acre tract was the Mahoning; the area where the Hull-Rust mine was later developed, "alongside the Mahoning," was, as Hill remembered, "covered with stumps and some uncut pine." His son had asked him to look at the Wright & Davis property. "We looked it over," Hill told the committee. "I bought that property largely on what I considered the value of the Mahoning mine. I could see there was no loss in it, if there was no other ore on the property. I took the whole thing" (Stanley committee hearings, vol. 4, pp. 3155–3156, 3172, 3239).

[76] Stanley committee hearings, vol. 7, p. 5363. Cf. ibid., pp. 5362–5363, 5378 ff., for further details regarding Sellwood's experience. He had been superintendent or general manager of various iron mines, and a vice president of Duluth & Iron Range R. R.; he had "bought all the properties of the American Steel & Wire Co. on the Mesabi Range, and also Menominee and Marquette afterwards," had examined ore properties and estimated deposits for Hill and others, from the Lake Superior region to Wyoming, Utah, and Texas. When he testified before the Stanley committee he was managing mines of his own and, he said, was "interested in some of Pickands Mather & Co."

[77] Ibid., p. 5417.

In addition to the ore controlled by Cambria, Bethlehem acquired Midvale's ore interests. These included holdings in New York, on the Gogebic and Mesabi Ranges, Buena Vista Iron Co. of Cuba, and ore concessions (later forfeited) in Mexico.[78]

Since the Lackawanna and Midvale-Cambria transactions, Bethlehem has continued to seek ore supplies both at home and abroad, and it has also continued to absorb formerly independent enterprises, pressing on toward further integration. But not since 1923 has it acquired a steel company and an ore property at the same time, although it was ready to merge with Youngstown in 1930.[79] Between 1923 and the end of 1948, Bethlehem purchased interests in a dozen or more domestic iron mining companies [80] and acquired the foreign ore holdings now in the course of development.[81]

REPUBLIC STEEL CORP.

Republic Steel Corp., primarily an operating company, was originally incorporated in New Jersey in 1899 as Republic Iron & Steel Co., with $47,500,000 issued stock. It was a consolidation of 24 companies manufacturing bar-iron and rolled-iron products, with plants principally in Ohio and Indiana, but also in Alabama and other States. "In all, it included 5 blast furnaces and about 30 rolling mills * * *. The primary object of this consolidation," said the Commissioner of Corporations quite flatly, "was restriction of competition. A large stock bonus to the promoters was also a feature of its organization." [82]

Acquisitions of ore properties

As in the case of United States Steel, the consolidation brought with it certain ore properties. The Commissioner of Corporations said:

> However, the company even at its formation showed some degree of integration. Through subsidiary concerns it acquired several iron mines in the Lake Superior district, as well as coke property in the Connellsville region. It also had some southern ore and coal properties.[83]

The mills of the combined companies were rather widely scattered, of varying ages, and of different degrees of efficiency. Obsolete, dis-

[78] Cf. Fortune, Apr., 1941 ("Bethlehem Steel"), p. 144:
"The problem was to get a supply of Lake Superior ores, and since they were all leased out, the solution was to buy a company that had some. Luckily, this alternative coincided with the management's yearning to make Bethlehem, whose ingot capacity was only about three million gross tons, dominate the East.
"From both standpoints there were two very desirable properties in the East. One was the Lackawanna Steel Co. near Buffalo, which not only controlled some ore in Michigan but enjoyed the geographical advantage of being close to eastern markets, economically close to the ore supply, and by lake close to the rapidly growing Detroit market. Bethlehem paid $57 million for Lackawanna in 1922. The other was Midvale Steel & Ordnance. In 1923 Bethlehem acquired its Cambria plant at Johnstown and its factory at Coatesville for $127 million, Midvale keeping the Nicetown (Philadelphia) plant for itself. * * * What made Cambria emphatically worth coveting was its 50-percent stake in a lease on the Mahoning ore pit in the great Hull-Rust mine near Hibbing. This gave Bethlehem an assured supply of more than 100 million tons of Minnesota iron ore."

[79] The merger was blocked by an injunction obtained in the Common Pleas Court of Mahoning County, Ohio, by minority stockholders of Youngstown who hoped to see the company included in the projected Midwestern Steel Co.; and in October 1931, the proposed consolidation of Youngstown and Bethlehem "was abandoned * * * as a result of the termination by Bethlehem Steel Corporation of the agreement between the companies" (Youngstown Sheet & Tube Co., Annual Report, 1931, p. 3). Later, in August 1932, the Ohio Court of Appeals held that the merger should not have been enjoined. By that time, however, the efforts to bring Midwestern Steel into being in accordance with the original plan had been suspended, though the merger that resulted in Republic Steel Corp. (Republic Iron & Steel Co. was to have been the nucleus of Midwestern) had been accomplished in 1930.
For further details concerning the plans for Midwestern Steel and the proposed consolidation of Bethlehem and Youngstown, cf.: TNEC hearings, pt. 18, pp. 10256–10279; Harlan Hatcher, A Century of Iron and Men, pp. 252–256; Fortune, June 1930 (Clash of Steel), pp. 68–69 ff; Bethlehem Steel Corp., annual reports, 1930–31; Youngstown Sheet & Tube Co., annual reports, 1930–32.

[80] One of these companies was subsequently liquidated; Bethlehem's interest in another was later sold.

[81] From the most important of these, the El Pao property of Bethlehem's Iron Mines Co. of Venezuela, ore shipments have been received since March 1951.

[82] Report on the Steel Industry, pt. I, p. 94.

[83] Ibid., p. 94.

advantageously located, and otherwise undesirable properties were soon dismantled and sold or abandoned; a large Bessemer steel plant was built at Youngstown, Ohio; and the northern operations of the company became centralized in and near the Mahoning Valley. At the same time, however, Republic was active in acquiring other iron and steel companies and ore supplies commensurate with its increased steel-making capacity.[84]

By 1911 Republic was probably in as happy a situation with respect to iron ore as it has ever enjoyed. When, during his appearance before the Stanley committee, John W. Gates was asked, "* * * where do you get your ores now?", he replied, "Mine them." Continuing, he said:

> All the important concerns that I know in the iron and steel business own a certain part of the ore that they use. * * *. Some might own 100 percent. In the case of the Republic, we are selling 50 percent.[85]

In the decade 1910–20, Republic made extensive additions to its Youngstown facilities, and seems not to have concerned itself with raw materials aside from acquiring some coal and coke properties. By the end of 1925, however, it had bought two ore companies and a half-interest in each of two others. Its ore reserves were further increased in 1928, when Republic acquired Trumbull Steel Co., Warren, Ohio. Trumbull Steel Co., which had been incorporated in Ohio in 1912, had acquired one-fourth of the capital stock of Mesaba-Cliffs Iron Mining Co., in which Cleveland-Cliffs Iron Co. had an equal interest; and since 1920 it had been a partner with Cleveland-Cliffs in Trumbull-Cliffs Furnace Co., which the two companies in 1920 had joined in organizing, Cleveland-Cliffs having "made that investment for the purpose of selling iron ore." [86] Thus no ore was acquired by Republic with Trumbull Steel's half-interest in Trumbull-Cliffs Furnace;[87] but through Trumbull Steel there was obtained an interest in Mesaba-Cliffs Iron Mining Co.[88]

"On April 7, 1930, Republic Steel Corp. was incorporated in New Jersey, and, pursuant to a plan dated January 15, 1930, it acquired the assets and assumed the liabilities of Republic Iron & Steel Co., Central Alloy Steel Corp., Donner Steel Co., and the Bourne-Fuller Co." [89] Of the three previously independent companies absorbed by Republic at this time, only Donner Steel Co. controlled any iron ore.[90]

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[84] By 1902 it had obtained a three-fiftieths interest in Mahoning Ore and Steel Co. (Moody's Manual, 1902, p. 1630), and in about that year it acquired an interest in additional Michigan ore. In 1906 it bought a half interest in Potter Ore Co., Birmingham, Ala., as an equal partner of Tennessee Coal, Iron & Railroad Co. (John A. Topping, chairman of the board of Republic Iron & Steel Co., told the Stanley committee that he "purchased for the joint account of the Republic Iron & Steel and Tennessee Coal, Iron & Railroad Co.'s a tract of mineral known as the Potter group of mines, and that is supposed to contain—at least we satisfied ourselves that it contains—something over 70,000,000 tons of iron ore * * *" (Stanley committee hearings, vol. 2, p. 1256). Republic's interest in Potter Ore Co. was sold to United States Steel in 1938. Within its first decade, Repuolic also acquired a one-half interest in Union Ore Co., Virginia, Minn. It may have been during this period that Republic acquired the "very large ore property at Fort Henry, N. Y., that produces about a million tons of ore a year," referred to by John W. Gates in his testimony before the Stanley committee (Stanley committee hearings, vol. 1, p. 53).

[85] Stanley committee hearings, vol. 1, p. 53.

[86] TNEC hearings, pt. 18, p. 10270. Testimony of E. B. Greene, president, Cleveland-Cliffs Iron Co.

[87] At the end of 1929, Republic acquired the remaining 50 percent of the stock of Trumbull-Cliffs Furnace Co.

[88] It is believed that Republic acquired the entire former interest of Trumbull Steel, viz., 25 percent, though there is some uncertainty on this point.

[89] Report of the Federal Trade Commission on the Merger Movement, p. 97.

[90] Donner Steel Co. had been incorporated in New York in 1915, as successor to New York State Steel Co., incorporated in New York in 1905. In 1911 New York State Steel Co. was reported to have four leaseholds on the Mesabi Range estimated to contain 3,500,000 tons of Bessemer and non-Bessemer ore (Moody's Manual (Industrials), 1911, p. 3239). Whether the properties in question were still producing or if they were still controlled by Donner Steel when that company was absorbed by Republic is unknown; but Republic did at least acquire Donner Steel's wholly owned subsidiary, Donner Mining Co., which held under a lease expiring in 1941 the Alexandria iron mine in St. Louis County, Minn. This mine was said to produce a minimum of 200,000 tons of ore per year (Moody's Manual (Industrials), 1928, p. 443).

A far more important acquisition from the standpoint of augmenting ore resources,[91] was its purchase of Corrigan, McKinney Steel Co., the properties, assets, and liabilities of which were taken over by Republic as of September 24, 1935.[92] "At the time of [Corrigan, McKinney's] acquisition, it was estimated that its iron-ore reserves were in excess of 50,000,000 gross tons, and its reserves of coking coal were approximately 44,600,000." [93] Corrigan, McKinney Steel Co. can probably be said without serious inaccuracy to have succeeded a business established in the nineties,[94] though there seems to have been an earlier partnership and though Capt. James Corrigan, the founder of the business, must have been interested in iron ore as early at any rate as the later seventies.[95] Though Corrigan, McKinney owned and operated blast furnaces at least as early as 1908, they seem to have been still primarily an ore company in 1911 and 1912, when the Stanley committee was holding its hearings. L. C. Hanna, formerly a member of the firm of M. A. Hanna & Co. and "a stockholder in mining interests" when he testified in 1911, included Corrigan, McKinney in the list of those he "would call the larger operators of the so-called merchant's mine," and told the committee, "I think those I have named all own large amounts of ore." [96] James J. Hill mentioned Corrigan, McKinney as a lessee of a Great Northern ore property,[97] and, replying to a question regarding ownership of ore

[91] It should perhaps be noted that Donner Steel's 50 percent interest in Donner-Hanna Coke Corp. was also acquired by Republic in the Donner Steel transaction.

[92] The merger had been promoted by Cleveland-Cliffs Iron Co., which had a 62.5-percent interest in Corrigan, McKinney, purchased in 1930 (TNEC hearings, pt. 18, pp. 10259–10261, 10273).

[93] Report of the Federal Trade Commission on the Merger Movement, p. 101. Cf. Fortune, Dec. 1935 (Republic Steel), p. 147, where Republic is said to have "got for its money: (1) a modern steel plant at Cleveland with 14 open-hearth furnaces and an ingot capacity of 1,000,000 tons a year to add to Republic's own 5,000,000; (2) dock facilities at Cleveland extensive enough to handle all Republic's ore shipments, thereby saving Republic, hitherto dockless, a pretty penny in dock charges; (3) a sheet mill at Monroe, Michigan, 20 miles from Detroit, which in 1933 sold 3.3 percent of all steel sheet produced; (4) 50,000,000 tons of ore in the Minnesota and Michigan hills, a 20-year supply for the combined companies. This doubles Republic's Lake Superior reserves."

[94] Cf. Fortune, December 1935 (Republic II: Corrigan, McKinney), p. 83: "The Corrigan, McKinney Steel Co. was the creation of two men. A hard-driving, broad-shouldered, loud-swearing Irishman named Jim Corrigan sired it. A precise, methodical bookkeeper named Price McKinney reared it up into the tenth biggest steel company in the nation.

"Captain Jim Corrigan was a smart operator. Twice he clashed with John D. Rockefeller in his prime—and survived. The first time he won, selling out his flourishing oil business to a disgruntled Rockefeller who had vainly tried to ruin it. But he was outsmarted later when a triumphant Rockefeller foreclosed some notes and took away from Captain Jim some nice little iron ore properties which he later sold at a fancy price to the Steel Corp. Undismayed, Captain Jim went into partnership with Judge Stevenson Burke, of Cleveland and soon had some new iron mines, a string of boats, and a growing ore business. * * * Price McKinney * * * ultimately (1894) became a partner in the new firm of Corrigan, McKinney & Co. (the '& Co.' representing mostly Judge Burke)."

It is apparently this firm which the financial manuals meant when, during most of the years (beginning only in 1925) that Corrigan, McKinney was listed under one or another of its various names, they spoke of "a business established in 1896" which "The McKinney Steel Company (name changed to Corrigan, McKinney Steel Co. in 1926)" was "formed in 1916 to succeed" (Moody's Manual (Industrials), 1929, p. 1827), or referred to The McKinney Steel Co. as having been "founded in 1916, succeeding a business established in 1896" (Poor's & Moody's Manual Consolidated, 1925, Industrial Section, vol. II, p. 1657). Also to be found, however, are statements to the effect that Corrigan, McKinney Steel Co. was "incorporated under Ohio laws in May 1901, under name of Quinnesec Iron Mining Co., name changed to McKinney Steel Co. in Dec. 1917; present name assumed Sept. 22, 1926" (Cf. Moody's Manual (Industrials), 1933, p. 2468; Poor's, 1933, p. 2253, says substantially the same).

Whether Quinnesec was the corporate alter ego of the Corrigan, McKinney & Co. partnership, whose name it later assumed, or whether it stood in some other relationship to the earlier firm—this has not been ascertained. Fortune's account (op. cit., p. 83) of Corrigan, McKinney implies that the "40 percent interest in the firm" left by Captain Corrigan at his death in 1908 was a stock interest; and there is specific reference to "the Corrigan 40 percent of the stock" and the McKinney 30 percent stock interest as of 1917; and it is as Corrigan McKinney that the company is referred to in the Stanley committee hearings.

[95] Cf. TNEC hearings, pt. 18, p. 10220 (testimony of Elton Hoyt II): "Early in 1870 enough ore had been developed on the Menominee Range * * * to warrant mining, but shipping was delayed until 1877, until the Chicago & Northwestern Railway Co. had built a line from Quinnesec to Escanaba and the initial shipment from this territory amounted to about 10,000 tons."

In 1900, Corrigan, McKinney had valuable holdings on the Menominee Range, and in 1910 they ranked third in shipments from that range, their tonnage being exceeded only by Pickands Mather and Oliver (Stanley committee hearings, vol. 6, pp. 4105–4106; vol. 7, p. 5523).

[96] Stanley committee hearings, vol. 2, pp. 891–892.

[97] This was almost certainly the Stevenson mine, from which a total of 13,994,028 gross tons of ore had been shipped up to January 1, 1950 (Great Northern Iron Ore Properties, Annual Report of the Trustees for Year Ending December 31, 1950). Shipments from the Stevenson mine in 1910 amounted to 953,079 tons (Stanley committee hearings, vol. 7, p. 5521).

"by anybody but the large steel corporations," named Corrigan, McKinney among those, outside the class of large steel corporations, he thought "were all holders of a considerable amount" of ore.[98] Thomas F. Cole, asked to identify Corrigan, McKinney, told the committee, "They are sellers of iron ore; also manufacturers of pig iron." [1]

The development of Corrigan, McKinney from an ore and furnace company into a large producer of steel cannot be traced in detail. But for some years before Cleveland-Cliffs Iron Co. in 1929 incurred a debt of $25,000,000 to purchase its 62½-percent interest in Corrigan, McKinney,[2] the latter had been an integrated steel company. While there were those who thought its products to be insufficiently diversified, it had long had important ore interests in the Lake Superior region, with holdings on the Gogebic, as well as on the Menominee, and Mesabi Ranges. In 1910 it accounted for 10.74 [3] percent of the total tonnage of Lake Superior iron ore shipped by independent companies (i. e., all except Oliver Iron Mining Co.).

Republic continued after the merger of Corrigan, McKinney to extend its ore interests by purchasing and leasing additional properties.[4] Within less than 2 years after the Corrigan, McKinney transaction, it increased its ore reserves by the acquisition of another steel company—Gulf States Steel Co., Gadsden, Ala.—all of the properties and assets of which were acquired on April 6, 1937. "The vending company's properties included an integrated steel plant * * * consisting of by-product coke ovens, blast furnaces, open-hearth furnaces, blooming mill, plate mill, bar mills, rod and wire mills, sheet mills, and nail and fence machines, as well as extensive iron ore and coal properties." [5]

Republic's purchase of Gulf States Steel was the last transaction by which it indirectly acquired any ore properties or interests. However, in recent years, joining with other companies, it has interested itself in the beneficiation of magnetic taconites (Reserve Mining Co.), and in exploration and development in Labrador (Iron Ore Co. of Canada); it has a substantial interest in Liberia Mining Co., and has obtained iron-ore concessions in Venezuela.

JONES & LAUGHLIN STEEL CORP.

Jones & Laughlin Steel Corp., incorporated under the laws of the State of Pennsylvania in 1922, is the successor to Jones & Laughlin Steel Co., incorporated in Pennsylvania in 1902. It was the successor to Jones & Laughlins, Ltd., formed in 1900 to consolidate "two limited partnerships—Laughlin & Co. (Ltd.), with a capital stock of $900,000,

[98] Stanley committee hearings, vol. 4, pp. 3181, 3236.
[1] Ibid., vol. 7, p. 5511.
[2] TNEC hearings, pt. 18, p. 10273.
[3] Stanley committee hearings, vol. 7, pp. 5521–5523.
[4] Penokee Ore Co. was acquired about 1937. In 1938, Republic leased the ore properties of Witherbee-Sherman Corp., Port Henry, N. Y., and in 1939 leased the iron ore mine and sintering plant of Chateaugay Ore & Iron Co., Lyon Mountain, N. Y. This property was purchased in 1944.
[5] Report of the Federal Trade Commission on the Merger Movement, p. 103. Of the ore properties that belonged to Gulf States Steel, the Shannon mine has not been operated for some years, according to testimony given before the Celler committee in April 1950, by C. M. White, president of Republic. "We had to make our decision," he said, "on whether we would continue to operate the Shannon mine or whether we would purchase brown ore. * * * It is a deep mine, and there is a tremendous capacity of ore there yet. It is watered. We pulled the equipment out of it. We own the reserves. We quit operating it and we elected to buy brown ore" (hearings before the Subcommittee on Study of Monopoly Power, Committee on the Judiciary, House of Representatives, 81st Cong., 2d sess. (these hearings will hereinafter be cited, by the name of the committee's chairman, as Celler committee hearings), Serial No. 14, p. 4A ("Steel"), p. 207).

operating the Eliza Furnaces, and Jones & Laughlins (Ltd.), with a capital stock of $4,000,000, operating the American Iron & Steel Works. These interests were at all times a prominent factor in the industry," wrote the Commissioner of Corporations in 1911, "and they later greatly expanded their operations." [6] The consolidation of 1900 was capitalized at $20,000,000; the corporation of 2 years later had a capital of $30,000,000 and authorized bond issue of $10,000,000, which was later increased. As it expanded, the company "carried the policy of integration to an advanced point," until in 1911 the Commissioner of Corporations considered Jones & Laughlin to be "perhaps the most important factor in the steel industry outside of the United States Steel Corporation." [7]

Acquisition of ore properties

At its organization, Jones & Laughlin Steel Co. owned Inter-State Iron Co., through which it held ore properties and leases and operated mines in Minnesota.[8] Through Inter-State Iron Co., it also owned Jones & Laughlin Ore Co., which performed similar functions in Michigan and New York. Moreover, it had stock interests in mines it did not own or control. Jones & Laughlin Steel Co. was repeatedly mentioned in testimony before the Stanley committee relative to the steel companies' ore supplies. John W. Gates knew Jones & Laughlin as "large owners and producers of ore," [9] and they were named by Judge Gary among the companies having "large holdings" on the Mesabi Range.[10] James Gayley [11] mentioned Jones & Laughlin as owning an operating mine on the Marquette Range [12] and recalled their having some property on the Gogebic Range when he visited there.[13] Joseph Sellwood spoke of Jones & Laughlin as owning "big deposits" on the Mesabi Range and told of having "sold a piece of property to Jones & Laughlin 5 or 6 years ago,[14] about 8,000,000 tons." Somewhat later in his testimony, he gave 75,000,000 tons as a "rough estimate" of Jones & Laughlin's holdings on the Mesabi Range.[15] At least some of these holdings were leases of Great Northern ore properties which antedated the lease to United States Steel.

Following the termination of the Great Northern lease to the steel corporation, Jones & Laughlin's subsidiary, Inter-State Iron Co., was among the first to acquire leases of developed properties. With this exception, however, for more than 20 years after the incorporation of Jones & Laughlin Steel Co., the company was relatively inactive in acquiring ore properties or interests in ore mining companies. Its

[6] Report on the Steel Industry, pt. I, p. 64.
[7] Ibid., pp. 95–96.
[8] Thomas F. Cole identified the Inter-State Iron Co. to the Stanley committee as "a mining corporation in Minnesota for the Jones & Laughlin people" (Stanley committee hearings, vol. 7, p. 5511).
[9] Stanley committee hearings, vol. 1, p. 56.
[10] Ibid., vol. 1, p. 89.
[11] James Gayley, who had at one time been in charge of procuring Carnegie Steel Co.'s raw materials and who was a Carnegie partner after 1892, upon the formation of United States Steel Corp. became "its first vice president," with "general supervision over the procuring and assembling of * * * raw materials." His connection with United States Steel ceased with his resignation and retirement on January 1, 1909 (Stanley committee hearings, vol. 1, pp. 303–304, 313, 377).
[12] This he identified as the "Lake Angeline" mine (evidently the same as the "Angeline" mine from which trade statistics show 244,923 tons of ore to have been shipped by the Pittsburgh & Lake Angeline Iron Co. in 1910). In 1910 Jones & Laughlin Ore Co. shipped 115,193 tons of ore from the Marquette Range (Stanley committee hearings, vol. 1, p. 394; vol. 7, pp. 5518, 5519, 5522).
[13] Stanley committee hearings, vol. 1, p. 395.
[14] He was testifying in April 1912.
[15] Stanley committee hearings, vol. 7, pp. 5366–5367, 5371. Records of St. Louis County, Minn., for the year 1908 showed Jones & Laughlin's subsidiary, the Inter-State Iron Co., as the operating company for seven mines in that county (op. cit., pp. 5570, 5571, 5580, 5581, 5585, 5589). Ore from four of these mines, from which shipments were made in 1910, amounted to more than 1.4 million tons of ore (op. cit., pp. 5522, 5523).

reserves were considered large. Besides its captive and partly owned mines that were producing, it had interests in undeveloped properties; it had ties with Cleveland-Cliffs going back to the days when the two companies had united to substitute a railroad for the plank road over which mules had pulled ore in a 3-ton car from Ishpeming to Marquette, Mich.;[16] it was still possible for a steel company to buy ore from others and conserve its own.

Between 1900 and 1921, Jones & Laughlin's blast furnace capacity was expanded from 996,800 to 2,352,000 net tons, and its ingot capacity by more than 2 million net tons.[17] During the next two decades its blast furnace and ingot capacity were both increased by more than a million net tons, without benefit of merger or purchase of plants. Integration during this period, when the company was seeking diversification of products and broader fields of activity, was principally of the forward vertical type, most of the companies acquired being fabricators and operators of warehouses and oil field supply outlets.

In 1942, however, Jones & Laughlin made the largest acquisition of its history when it bought Otis Steel Co., which not many years before had come close to being absorbed by Republic.[18] Otis Steel Co. had been incorporated in Ohio in 1912 to acquire the business and properties of Otis Steel Co., Ltd., an English corporation registered in 1895. In 1919, Otis acquired the business and assets of Cleveland Furnace Co., Inc., which had been incorporated in New Jersey in 1902 to manufacture and sell pig iron. Cleveland Furnace (owned, it appears, by Cleveland-Cliffs [19]) was reported in 1919 to own "substantial interests in five iron-ore properties * * *;" [20] and Otis obtained interests in three ore companies. Among these was a 4.375-percent interest in Mesaba-Cliffs Iron Mining Co., recently organized under the auspices of Cleveland-Cliffs to lease certain Great Northern properties. In its annual report for 1920, Otis stated:

> A considerable sum * * * has been expended in the acquisition of an interest in the Mesaba-Cliffs Iron Mining Company for the purpose of increasing our own source of supply of iron ore.

From at least 1923 to 1930 (after which it becomes difficult to trace the division of ownership) Otis held a 12½-percent interest in Mesaba-Cliffs Iron Mining Co., while Cleveland-Cliffs held 25 percent. But by 1936 Otis' only ore holdings consisted of a considerably reduced interest in Mesaba-Cliffs; and its ore requirements, beyond the share of Mesaba-Cliffs' production which it could claim, were being supplied under a long-term contract with Cleveland-Cliffs.[21] When Jones &

[16] TNEC hearings, pt. 18, p. 10270.

[17] In the late twenties ore property was acquired in Cuba, and in 1933 the company purchased a 75-percent interest in Lucky Star Mining Co., Negaunee, Mich.

[18] Otis was a manufacturer of steel and steel products, and in 1938 had been among the 10 companies in the United States having the largest productive capacity for hot-rolled black sheets, hot-rolled strip, cold-rolled strip, and plates. Jones & Laughlin did not rank among the first 10 in capacity for the first three of these products, though in plates its capacity exceeded that of Otis (TNEC hearings, pt. 18, p. 10409). Since Otis' properties were in Cleveland, Jones & Laughlin acquired an advantageous plant location at the same time that it strengthened its position with respect to certain steel products.

[19] Four of the seven directors of Cleveland Furnace listed in Moody's Manual (Industrials), 1919 (pp. 172, 2344), were also directors of Cleveland-Cliffs. Cf. TNEC hearings, pt. 18, p. 10265, testimony of E. B. Greene, president, Cleveland-Cliffs Iron Co.: "We turned in the Cleveland furnaces to Otis, and were paid in stock, so that what we had formerly was a furnace and what we had later was stock."

[20] Moody's Manual (Industrials), 1919, p. 172.

[21] In the course of his testimony before the Temporary National Economic Committee, E. B. Greene of Cleveland-Cliffs was asked concerning Otis: "And you supply them with a very large proportion of their ore?" He replied: "Yes; all but what they own themselves, which is small" (TNEC hearings, pt. 18, p. 10279).

Laughlin purchased Otis, a 4.5-percent interest in Mesaba-Cliffs was included in the assets acquired.[22]

YOUNGSTOWN SHEET & TUBE CO.

Youngstown Sheet & Tube Co., which is primarily an operating company, was incorporated under Ohio laws on November 23, 1900, as Youngstown Iron Sheet & Tube Co.,[23] the present name having been adopted in 1905. During the 2 years following its incorporation, the company was building its plant. In 1909 and again in 1912, it expanded, purchasing in each instance the plant of another company.

As early as 1902, Youngstown began to acquire interests in Lake Superior ore properties,[24] and throughout its history the company appears to have followed the policy of trying to be the major source of its ore requirements. In general, its ore holdings have been acquired directly, by outright purchase of ore properties, mining companies, or leases, or of shares of these, rather than through iron and steel companies with which it has merged, though more than 25 years ago there were certain important indirect acquisitions.

"During 1916, all of the outstanding capital stock of the Andrews & Hitchcock Iron Co. was purchased by the Youngstown Sheet & Tube Co. The properties and assets of The Brier Hill Steel Co. and the Steel & Tube Co. of America were acquired during 1923." [25]

"Included in the [Andrews and Hitchcock] deal," according to Moody, "was the transfer of an interest in certain ore and coal rights and in Lake Steamship companies." [26] The size or nature of these ore rights have not, however, been ascertained.

Early in 1923, immediately preceding the first of Youngstown's two largest acquisitions, the company had interests in ore properties on the Marquette, Menominee, Gogebic, Mesabi, and Vermilion Ranges.[27]

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[22] About a year before the acquisition of Otis Steel, Jones & Laughlin, "through its subsidiary, Jones & Laughlin Ore Co., * * * leased from the Benson Iron Company, Inc., the Benson Mine ore propert to provide future ore reserves for the corporation. Despite the fact that this ore property was leased t provide ore reserves for the future, in order to assist in increasing steel production and at the request of th Federal Government, Jones and Laughlin Ore Company, in October 1941, filed with the Office of Production Management a plan to open up and equip the Benson ore property for production with Government funds, and a contract for this purpose [was] entered into with the Government" (Listing Statements of the New York Stock Exchange, A-11623, Jones & Laughlin Steel Corp., May 27, 1942, p. 3). The "estimated or completed cost" of this project, according to the Surplus Property Administration's Report to Congress on Disposal of Government Iron and Steel Plants and Facilities (October 8, 1945) was $7,000,000.

The facilities in question, located in St. Lawrence County, N. Y., and operated by Jones & Laughlin under lease from the Defense Plant Corporation, consisted of an iron-ore beneficiating plant (including crushers), a concentrating plant, a sintering plant, shops, trucks, and other equipment. All were purchased by the Jones & Laughlin Ore Co. in December 1946.

[23] The company apparently came into being as an indirect result of the organization of National Steel Co. in 1899. Ohio Steel Co., which was included in this consolidation of competing producers of crude steel and heavy steel products, was a Youngstown enterprise. It had completed its works and begun to make steel in February 1895, and had erected two blast furnaces and made other additions in 1898. The superiority of its plant and the earning power anticipated for it were reasons for not leaving Ohio Steel out of the combination. Further, it brought to National a one-fourth interest in the lease of the Biwabik mine. It was recalled by a former vice president and director of Ohio Steel who later became a stockholder in the new company that "after the sale of [the Ohio Steel] plant a considerable amount of capital was available in Youngstown, and the result of this was the building of other plants, among which was that of the Youngstown Sheet & Tube Company * * *. It was * * * at first meant to be a small concern." But, besides the original enterprisers, "several other men who had made money in the Ohio Steel Company saw a chance to reinvest their profits, and offered to join," if the plans were enlarged. This was agreed to, and the new corporation was formed (Joseph G. Butler, Jr., *op. cit.*, pp. 137-138).

[24] Crete Mining Co., incorporated in Minnesota in 1902, held one of the earlier Great Northern leases. Youngstown appears to have had a majority interest.

[25] Report of the Federal Trade Commission on the Merger Movement, p. 113.

[26] Moody's Manual (Industrials), 1916, p. 3873.

[27] Cf. Listing Statements of the New York Stock Exchange, A-5921, Youngstown Sheet & Tube Co., January 16, 1923:

"The company acquired at various times interests in the following iron-ore-mining properties: 66⅔ percent the Balkan Mining Co., which owns and operates properties in the Mesabi Range, Minn., and the Menominee Range, Mich.; 60 percent Crete Mining Co., 10 percent Hoyt Mining Co., 12 percent Mahoning

Brier Hill Steel Co., incorporated in Ohio in 1912, was a consolidation of the long-established Brier Hill Iron & Coal Co. and Youngstown Steel Co., both of Youngstown, Ohio, and of Thomas Steel Co., and Empire Iron & Steel Co., both located at Niles, Ohio. In 1921, Brier Hill owned 75 percent of the capital stock of Biwabik Mining Co. of Ohio,[28] a half-interest in Pennington Mining Co., and a half-interest in Orwell Iron Co., with mines in Minnesota.[29] It also owned the entire capital stock of Brier Hill Steamship Co., which had been organized in 1920 to acquire a freighter for the transfer of ore on the Great Lakes.[30]

Further integration on the part of Youngstown was accomplished when at the end of June 1923 it succeeded in acquiring Steel & Tube Co. of America.[31] This company, incorporated in Delaware in 1918, was a consolidation of Iroquois Iron Co. and Mark Manufacturing Co. Integration had been the purpose of the consolidation, which the new company rather promptly set about to carry further, moving vertically backward to acquire mining properties.[32] One of these was Newport Mining Co., owning and operating mines on the Gogebic Range. Its lands and the holdings of a subsidiary were estimated in 1918 to contain an aggregate of approximately 15 million tons of ore.[33] Another was Northwestern Iron Co., incorporated in Wisconsin in 1854 and one of the oldest iron furnaces in the United States. Its properties included 1,243 acres of ore lands in Dodge County, Wis., estimated in 1919 to contain more than 10 million tons of proven ore. These two companies were acquired and merged in 1919.[34] The following year the company acquired through a long-term lease the Isabella mine on the Marquette Range. When Steel & Tube Co. of America was absorbed, properties which it owned or controlled through wholly owned subsidiaries included fully equipped iron mines located in Michigan and Wisconsin with iron-ore reserves of 33 million tons.[35]

The present relatively favorable position of Youngstown with respect to iron-ore reserves[36] would appear to be due in considerable part to its having, to a greater extent than some of its competitors, carried integration backward to ore properties without undertaking much expansion in other directions. It has not, however, ignored the possibility of having to resort to taconites (it holds 45 percent of the stock of Erie Mining Co.); and it has a 10-percent interest in Iron Ore Co. of Canada.

Ore & Steel Co., which owns and operates properties in the Mesabi Range, Minn.; 33⅓ percent Bennett Mining Co., 20.12 percent the Brule Mining Co., which owns and operates properties in the Menominee Range, Mich.; 20 percent Plymouth Mining Co., which owns and operates properties in the Gogebic Range, Mich.; 3⅓ percent Vermillion Mining Co., which owns and operates properties in the Vermilion Range, Minn.; 25 percent Volunteer Ore Co., which owns properties in the Marquette Range, Mich.

"By the acquisition of interests in the above-mentioned properties, the company has available for its use approximately 1,400,000 gross tons of iron ore per annum."

[28] The Brier Hill Co., identified to the Stanley committee as "one of the oldest concerns that has been in the iron business," was reported to own most of Biwabik in 1912 (testimony of Joseph Sellwood, Stanley committee hearings, vol. 7, p. 5371). Judge Gary recognized the Biwabik as a large mine (Stanley committee hearings, vol. 1, p. 110). The remaining interest in Biwabik was acquired by Youngstown in 1941.

[29] Orwell Iron Co. held "new leases" from the trustees of Great Northern iron-ore properties.

[30] Poor's & Moody's Manual Consolidated, 1922, industrial section, vol. I, pp. 640–641.

[31] The acquisition was delayed by injunction proceedings instituted by certain minority stockholders of the vending company. Cf. 120 Atl. 488 and 122 Atl. 142.

[32] Poor's & Moody's Manual Consolidated, 1922, industrial section, vol. II, pp. 1740–1741.

[33] Moody's Manual (Industrials), 1918, p. 1130.

[34] Moody's Manual (Industrials), 1919, p. 547.

[35] Poor's & Moody's Manual Consolidated, 1922, industrial section, vol. II, pp. 1740–1741.

Cf. Youngstown's Annual Report for 1923, where (p. 3) commenting upon the Brier Hill and Steel & Tube acquisitions, it was said: "Among the properties acquired by these purchases are valuable reserves of iron ore, coal, and limestone which greatly strengthen the position of your company in this respect."

[36] The interest shown in Youngstown in connection with certain projected mergers of the thirties may have derived, at least in part, from its controlling a good share of its ore requirements.

NATIONAL STEEL CORP.

National Steel Corp., which functions as both an operating and a holding company, was incorporated in the State of Delaware on November 7, 1929. It was a merger of three Delaware corporations—Weirton Steel Co. (incorporated in 1925), Great Lakes Steel Corp. (incorporated in 1929), and Hanna Iron Ore Co. (incorporated in 1928), and from the incorporation papers sprang a completely integrated steel company. This development may have surprised Charles M. Schwab who, at the time of the Stanley committee hearings, had questioned the probability of the appearance of any large new steel company.[37] The new company seems to have been planned with care; its "first public offering of securities * * * was in 1931"; and as late as 1950 the Securities and Exchange Commission could say, in a study prepared for the Celler committee, "So far as we have been able to ascertain, there has been no public financing through stock by the National Steel Corp. in its history." [38]

Weirton Steel began as Phillips Sheet & Tin Plate Co., which was incorporated in West Virginia in 1905 and entered the steel business with a plant obtained at a receiver's sale. By 1918, when it changed its name to Weirton Steel Co., it had purchased some plants and built the new mills that were the beginning of Weirton, W. Va. In that year it built its first blast furnaces, and in 1922 built a sheet mill. "By 1923 Weirton was at least partly integrated and comparatively diversified." [39] At approximately the time National was formed, Weirton had blast furnaces, open-hearth furnaces, and a coal-mining subsidiary, but it had no iron ore. Among its principal suppliers of ore was M. A. Hanna Co., of Cleveland.

Acquisitions of ore properties

M. A. Hanna Co. was incorporated in Ohio in 1922, but its history went back to a partnership established in the late sixties. From the beginning it had been in the iron-ore, coal, and investment business. In 1929, "M. A. Hanna Co. owned merchant blast furnaces, made and sold merchant pig iron, and owned ore mines." [40] It also owned and operated a fleet of boats on the Great Lakes. In December of the year preceding the organization of National Steel, Hanna Iron Ore Co. was incorporated to acquire certain subsidiaries of M. A. Hanna Co.

Great Lakes Steel Co. was only about 9 months' old as a corporation and was still building its plant when it became part of National Steel; but it was the product of plans for integration similar to (if on a smaller scale than) those which brought National Steel into being, and likewise involved M. A. Hanna Co. Hanna's president, George M. Humphrey, told the story to the Temporary National Economic Committee in the following testimony:

[37] Cf. Stanley committee hearings, vol. 2, p. 1291:
Mr. SCHWAB. I do not believe there will be any great development in iron and steel by new companies, but rather development by the companies now in business.
The CHAIRMAN. Now, explain that to us.
Mr. SCHWAB. For the reason that the possibility of a new company getting a sufficiently large supply of raw materials would make it exceedingly difficult, if not impossible. * * * I do not think it is possible to-day, with the known ore, for anyone to get a sufficiently large reserve to justify the very great expenditure of capital necessary to successfully manufacture * * * I do not want to make that statement absolute, but I say the chances are against that development.
[38] Celler committee hearings, serial No. 14, pt. 4–B (steel exhibits), p. 355.
[39] Fortune, June 1932 (National Steel; A Phenomenon), p. 34.
[40] TNEC hearings, pt. 18, p. 10284.

Mr. HUMPHREY. Well, in 1929 we had a merchant pig-iron business and we had more ore than we used in our own furnaces, and sold ore to other customers. We had a pig-iron business in Detroit. George Fink had a sheet-steel business in Detroit, and we decided that would be a wise thing to build a steel plant in Detroit which would take our pig-iron and supply the steel for Mr. Fink's sheets.

Mr. FELLER. You were also interested in Mr. Fink's business in Detroit?

Mr. HUMPHREY. We were; and we together formed the Great Lakes Steel Co., which was the connecting link between our pig iron, our iron ore, and his finished sheets.

Mr. FELLER. And there were at that time, in 1929, three companies, the Great Lakes Steel Corporation in Detroit, in which you and Mr. Fink were interested, the M. A. Hanna Co., operating iron-ore mines, and blast furnaces, and thirdly the Weirton Steel Co.?

Mr. HUMPHREY. Weirton Steel Co. was one of our largest customers for iron ore. We supplied them with iron.

* * * * * * *

Mr. FELLER. And the merger brought about National Steel, and consolidated these three interests, Great Lakes Steel, the iron-ore properties and blast furnaces of M. A. Hanna, and the properties of the Weirton Steel Co.?

Mr. HUMPHREY. Each of those units, you see, was supplementary to the other unit, and we found that by putting those supplementary units together in a single company we would have a stronger, better company group than we had as independents.

Hanna Iron Ore Co. had meanwhile acquired the Hanna "assets that related to the iron-ore and pig-iron business," and, upon the consummation of the merger, "became the raw-material department of the National Steel Co., and National Steel engaged the Hanna Co. to operate and handle their raw-material properties." [41]

INLAND STEEL CO.

Inland Steel Co., incorporated in Delaware in 1917, is the successor to a company of the same name incorporated in Illinois in 1893. It is primarily an operating company.

Acquisitions of ore properties

During its earlier years, from 1893 to 1909, Inland acquired ore lands on the Mesabi Range. It was identified to the Stanley committee as a consumer of iron ore having ore property in St. Louis County, Minn.[42] Trade statistics reproduced in the Stanley committee hearings show Inland to have shipped 189,046 tons of ore (all from the Laura mine) from the Lake Superior region in 1910.[43]

Between 1908 and the incorporation of Inland Steel Co. of Delaware early in 1917, Inland had more than doubled both its blast-furnace and its ingot capacity, this expansion having resulted entirely from internal growth.[44] Inland had also been taking thought for its future ore supplies. In 1916 it was reported: "[Inland] owns five valuable ore leases covering five producing mines, two on the Mesaba Range, at Hibbing, Minn., and three on the Cuyuna Range at Crosby, Minn. The ore reserves are said to be sufficient to insure a life of 30 years for each of the mines." [45]

Characteristic of the expansion of Inland (Delaware) down to 1930 was its acquisition of raw-material sources—interests in ore com-

[41] Ibid., pt. 16, p. 10284–10285 (Humphrey's testimony). Hanna retained its large coal properties.
[42] Stanley committee hearings, vol. 7, p. 5511.
[43] Ibid., vol. 7, pp. 5522–5523. Only this quantity was credited to Inland under its own name, though ore belonging to Inland might have been included in shipments by managing agents.
[44] In this period was formed (1911) Inland Steamship Co., controlled by Inland Steel and used for the transportation of ore and coal; and a byproduct coke plant was built (1913). (Inland Steamship Co. was dissolved in 1946 and its fleet taken over by the parent company.)
[45] Moody's Manual (Industrials), 1916, p. 2807.

panies,[46] coal companies, and limestone companies—while it was increasing its pig-iron and steel-making capacity, principally by additions to its plant. Certain acquisitions were made later, but none was of a sort that contributed to Inland's iron-ore resources.[47]

ARMCO STEEL CORP.

Since 1948, Armco Steel Corp. has been the name of the former American Rolling Mill Co., incorporated under the laws of Ohio in 1917 as the successor of a company of the same name which had been incorporated in New Jersey in 1899. Armco Steel Corp. is primarily an operating company.

Acquisitions of ore properties

The acquisitions of the original company seem to have been made for the sake of increased volume and somewhat greater diversification of product. The reincorporation of 1917, however, was in preparation for a merger which had backward vertical integration as its purpose—the union of American Rolling Mill Co. and Columbus Iron & Steel Co. The latter company, also organized in 1899, had been selling a substantial portion of its production of pig iron to American Rolling Mill Co., and brought into the combination not only its two blast furnaces at Columbus, Ohio, coal mines in West Virginia, and coke ovens, but also Lake Superior iron ore properties.[48]

Among the numerous acquisitions, mainly of fabricating companies, made by Armco during the next 30 years, there was none in which backward integration to ore accompanied the horizontal or forward vertical integration accomplished.[49]

Early in 1949, Sheffield Steel Co., a wholly owned Armco subsidiary, acquired for $7,150,000 a "Government-owned blast furnace and by-product coke oven at Houston, Tex., together with iron ore beds and beneficiating equipment at Lincoln and Jacksonville, Tex.," all of which were wartime facilities which the company had originally operated for the Government and which it had had under a 3-year lease since April 1947.[50]

WHEELING STEEL CORP.

Wheeling Steel Corp., which is principally an operating company, was incorporated in Delaware in 1920, and was a consolidation of Wheeling Steel & Iron Co. (incorporated in 1892), Whitaker-Glessner Co. (dating from 1875), and La Belle Iron Works (founded in 1852; incorporated in West Virginia in 1875).

[46] E. g., Orwell Iron Co., the ownership of which was shared equally by Inland and Youngstown, held "new" Great Northern leases.

[47] Inland's most important acquisition occurred in 1935, when it purchased Joseph T. Ryerson & Son, Inc., and established itself, immediately and on a comprehensive scale, as an operator of steel-service plants and warehouses. In the following year, the company added fabricating capacity and extended its distributing activities by the acquisition of Milcor Steel Co. But neither Ryerson nor Milcor gave Inland access to any raw materials. Earlier in the thirties Inland had acquired interests in ore companies which added to its Cleveland-Cliffs connections; and it continued, as opportunities arose, to fortify its ore position—acquiring its own mines, joining in the organization of mining companies, and investing in ore properties and leases and in mining-company stocks. Besides the ties with Cleveland-Cliffs mentioned above, Inland has also developed close associations with the Hanna group.

[48] Moody's Manual (Industrials), 1916, p. 2403. Details regarding these ore properties are lacking.

[49] Armco's somewhat late emergence as an integrated steel company, its relatively high degree of specialization, and the nature of its specialized products may have worked together to retard and restrict acquisitions of its own ore. It did, however, obtain interests in a number of ore companies during the latter half of the thirties, and it made further investments in such companies in 1948.

[50] Moody's Manual (Industrials), 1950, p. 2562.

Acquisitions of ore properties

It was the oldest of these companies that brought the most iron ore to the consolidation. La Belle Iron Works owned the entire capital stock of Pitt Iron Mining Co., which owned three operating mines with 15 million tons of proven ore on the Mesabi Range.[51] Whitaker-Glessner Co. contributed no ore; but Wheeling Steel & Iron Co. had certain claims to ore through stockholdings in mining companies, viz., Castile Mining Co., Fort Henry Mining Co., and LaRue Mining Co.[52]

Within the first 20 years following its incorporation, Wheeling increased its blast-furnace capacity and its ingot capacity, bought a plant from National Tube Co., acquired a number of fabricating companies, and acquired or organized several companies through which to distribute its products. But what Wheeling was doing, aside from acquiring some coal and coke properties, to supplement its raw material resources during this same period is less adequately reported. However, it must have obtained some additional ore properties or interests in ore companies between 1920 and 1940.[53] In a listing statement dated April 14, 1941, it was said: [54]

> It has been the Company's policy to purchase from others a substantial portion of the iron-ore requirements of its blast furnaces, and it is the intention of the company to continue to make such purchases. At the present time the Company has term contracts with two other corporations (not subsidiaries) giving them the right to purchase about 2,150,000 gross tons of iron ore during the next 6 years. This tonnage, together with the 14,600,000 gross tons of iron ore referred to in the second preceding paragraph [where "Raw Material Properties" were discussed], would be sufficient, based upon the Company's average consumption of 1,286,000 gross tons per year for the years 1936 to 1940 inclusive (1,604,000 tons were consumed during 1940) to cover the Company's requirements for about 13 years, even though no additional iron-ore properties should be acquired and no additional purchases should be made from others.

[51] Moody's Manual (Industrials), 1920, p. 931. According to trade statistics introduced at Stanley committee hearings, La Belle Iron Works shipped 236,612 tons of ore from its La Belle and Miller mines in 1910. Pitt Iron Mining Co. was reported in 1909 to be controlled by La Belle (Moody's Manual, 1909, p. 2582). At least one of its mining properties appears to have been managed by M. A. Hanna & Co. in 1910 (Stanley committee hearings, vol. 7, pp. 5522, 5518, 5584).

[52] Moody's Manual (Industrials), 1920, p. 2027. In listing the ore shipments from the Lake Superior region in 1910, the trade source referred to in the immediately preceding note credited the ore from the Castile mine to Oglebay, Norton & Co., and that from the La Rue mine to M. A. Hanna & Co. (Stanley committee hearings, vol. 7, pp. 5520, 5518).

[53] Cf. Great Northern Iron Ore Properties, Twenty-fourth Annual Report of the Trustees for Period Ended December 31, 1930, where a lease is reported (p. 10) to have been made by one of the proprietary companies to the Wheeling Steel Corp. on June 2, 1930.

[54] Listing Statements of the New York Stock Exchange, A-11504, Wheeling Steel Corp., April 14, 1941, Prospectus of March 14, 1941, p. 9.

PART III

IRON-ORE CONSUMPTION

In order to provide perspective in evaluating the effect of the impending change in sources of supply on competition in the steel industry, it is necessary first to examine the consumption pattern which actually prevailed in a recent year. How much ore did each of the major steel producers obtain; where did it come from; was it mined from properties which they owned or was it purchased from others; was it low-cost, open-pit, direct-shipping ore, or high-cost underground, concentrated ore? This information on actual consumption in the recent past provides the essential bench-mark data for an appraisal of the probable effects of changes in supply in the future.

For the purpose of making this examination of actual consumption patterns, the year 1948 was selected. It was a year of high output, coming before the temporary downturn in economic activity which set in during the early part of 1949.

Sources of ore in the United States

In 1948 the total production of usable iron ore in the United States amounted to 101 million gross tons. For all practical purposes this constituted the supply of iron ore available to users in this country. A small quantity of iron ore was imported, but this amounted to only 6 million gross tons.[1] An even smaller quantity, approximately 3 million gross tons, was exported. Clearly, as of 1948, the production of iron ore was still a domestic business, with importations from abroad playing a distinctly minor role.

The production of ore was highly concentrated, both on a geographic and on a company basis. Of the total domestic production, the Lake Superior district accounted for nearly 82 percent.[2] In 1948 this district, composed of the States of Minnesota, Michigan, and Wisconsin, accounted for 82.6 million gross tons. The State of Minnesota alone produced 68 million gross tons, about two-thirds of the total domestic production.

By comparison, other producing areas in the United States were of minor importance. The southeastern district produced only 8.3 million gross tons, primarily in Alabama. The western district, including Utah, produced 5.1 million gross tons; and the northeastern district—New Jersey, Pennsylvania, and New York—accounted for 4.4 million gross tons.

The country's iron ore production was also highly concentrated on a company basis. Of the total of 101 million gross tons, the nine major producers accounted for 87 million gross tons, or roughly 86 percent of the total supply. Furthermore, most of their production was centralized in the country's richest ore district. The Lake Superior district, which supplied about 82 percent of the total pro-

[1] Of this amount, 2.6 million gross tons came from Chile and 1.3 million gross tons from Sweden. The balance came from Canada, Algeria, Brazil, and other countries.

[2] Cf. Appendix table A-1 for a breakdown of domestic sources of iron ore from 1911 to 1949.

duction, accounted for nearly 92 percent of the production of the nine largest producing companies. Producing companies other than the nine largest had little part in exploiting the country's best sources of ore; in 1948 they accounted for a production of only 7 million gross tons in the Lake Superior region.

These 7 million gross tons constituted about half of the total production of iron ore outside of the control of the nine producrs already mentioned. The remaining 50 percent of the smaller companies' production came from the western and southeastern districts.[3]

An even more striking contrast of the positions of the nine largest companies and the smaller producers can be shown by comparing the amounts of crude ore and usable ore each group produced.[4] In 1948 all producers of ore in the United States accounted for a total of 126 million gross tons of crude ore. After treatment—concentration and beneficiation, etc.—this resulted in 101 million gross tons of usable ore.

The 80 million tons of crude ore coming from Minnesota supplied 68 million tons of usable ore. This meant a ratio of usable to crude in the neighborhood of 85 percent. Of the 14.6 million tons produced in Michigan and Wisconsin, all was usable ore. These three States constitute the Lake Superior district where the bulk of the production of the nine largest companies is concentrated.

TABLE 1.—*Production of usable ore as a percent of crude ore by 9 leading producers and by all producers by district for 1948*

[In 1,000 gross tons]

District	Production of crude ore		Production of usable ore		Percent of usable ore to crude ore		
	All producers [1]	9 producers [2]	All producers [1]	9 producers [2]	All producers [1]	9 producers [2]	All others
Grand total	126,225	102,062	[3] 101,003	87,133	80.00	85.4	57.4
Lake Superior district:							
Minnesota	79,871	[4] 73,386	68,036	[4] 62,340	85.2	84.9	87.8
Michigan and Wisconsin	14,595	13,299	14,595	13,299	100.0	100.0	100.0
Total Lake Superior	94,466	86,685	82,631	75,639	87.5	87.3	89.9
Southeastern district	13,293	5,571	8,365	5,469	62.9	98.2	37.5
Northeastern district	10,380	7,383	4,423	3,924	42.6	53.2	16.6
Western district [5]	8,087	2,122	5,105	2,101	63.1	86.7	53.0

[1] Data for all producers are from Bureau of Mines, Minerals Yearbook, 1948, pp. 629–635.
[2] Data for 9 leading producers are from company reports submitted on FTC questionnaires.
[3] Includes 480,000 tons of byproduct ore, not included in district totals.
[4] Includes some Michigan and Wisconsin production by Oliver Iron Mining Co.
[5] Western district includes Missouri.

In contrast, the northeastern district, with 10 million tons of crude ore, accounted for an output of usable ore of only 4.4 million tons, or about 43 percent of the crude production. In this area the small companies secured about 20 percent of their total output. The southeastern district accounted for 13 million tons of crude ore and 8.3 million tons of usable ore, a ratio of 63 percent. Only two of the nine producing companies reporting to the Commission showed any pro-

[3] About equally divided between the two districts.
[4] Cf. following table 1, Production of Iron Ore by Nine Leading Producers and Total Production for 1948 by Districts.

duction of ore in this district; and the accompanying table reveals that their production was almost wholly usable ore in a region noted for the generally low iron content of its ores. This means that the smaller producers in this area relied to a heavy extent on concentrated ores, with resulting additions to their costs.

The western district produced 8 million tons of crude ore and 5.1 million tons of usable ore. The two companies ranking among the nine largest had a ratio of usable ore to crude ore of 87 percent, while all other producers had a ratio of 53 percent. Here, too, the smaller companies were engaged in the exploitation of lower quality ores than those of their larger competitors; and in the consequent necessity for concentrating these ores, they incurred higher costs of production. The western district accounted for another 20 percent of the total production of the independents.

Of the four leading ore houses, only three are of substantial size. In 1948 Pickands Mather & Co., the largest, produced 14.1 million tons; M. A. Hanna Co. followed with a production of 10.3 million tons; Cleveland-Cliffs Iron Co. came next with an output of 8.5 million tons. Oglebay, Norton & Co., the smallest of the four, produced 1.5 million tons. All of these companies have their activities centered in the Lake Superior district, although M. A. Hanna obtains small amounts of ore in the northeastern and western districts.

None of the ore houses retained any of their iron-ore production for their own direct use. However, because of the extensive investments of the large steel companies in iron mines managed by the ore houses, less than half of the total production of these ore houses entered the open market. In 1948, of the total of 34.5 million tons produced by the ore houses, approximately half went to the nine largest steel companies, as a result of their ownership interests in mining companies managed by these ore houses. Most of the remaining tonnage went to these same steel companies on long-term contracts.

Thus, the position of the ore house in the industry is essentially that of satellite to the large, integrated steel companies. The ore house manages and operates mining properties in which the steel companies hold substantial investment interests. It also produces ore from its own properties—but most of this ore is committed to these same steel companies by long-term contract. This community of interest in domestic production is being further extended by joint exploitation of properties abroad, notably in the new Canadian developments.

Ore consumption in 1948

In 1948 103.8 million tons of iron ore were shipped to users in the United States.[5] Of this amount, 87.3 million tons, or approximately 84 percent, went to the nine largest steel companies.[6] Only 16.5 million tons were left to be divided among all other users—10 smaller integrated companies and 14 independent merchant iron producers. These two groups represented about 10 million net tons of blast-furnace capacity, and produced approximately 9.5 million net tons of pig iron in 1948.[7] In contrast, the nine largest steel companies had a

[5] Cf. appendix table A–2.
[6] Cf. appendix table A–3.
[7] Roughly half of the capacity was in the hands of each group.

total blast-furnace capacity of approximately 57 million tons, and produced over 51 million net tons of pig iron in that year.

The high degree of concentration in ore consumption stems principally from the dominant position of United States Steel Corp. In 1948, United States Steel alone had receipts amounting to 39.3 million tons—almost as much as all of the other eight companies combined. The two next largest companies, Bethlehem and Republic, received 14.6 million tons and 8.9 million tons, respectively. Together these three companies accounted for about 63 million tons, or 70 percent of the total of 87.3 million tons received by all of the nine companies.

The remaining 30 percent went to six other steel companies. Jones & Laughlin and Youngstown Sheet & Tube each received a little over 5 million tons; Inland Steel and National Steel, 4.6 million tons; Armco Steel, 1.9 million tons; and Wheeling Steel, 1.9 million tons.

The steel companies obtain their ore from a variety of sources. In some instances, they operate their own mines directly or through mining subsidiaries. In others, the steel companies own ore mines, but these properties are operated by and managed by merchant ore houses on a commission basis. This is particularly the situation where two or more steel companies have a financial interest in the same mines. If the supply from these sources is inadequate, the steel company may enter into long-term contracts with merchant ore houses to supply it with ore. It may also, on occasion, do some spot buying on the open market.

Most of the steel companies simultaneously make use of all of these practices for obtaining their iron-ore supplies. Their relative use of these methods has a direct and immediate impact upon their competitive position.

A steel company would prefer to have direct control of mining operations involving open-pit, direct-shipping ore. Such a situation presents clear-cut advantages. Ownership of ore supplies means greater security in the face of a depleting mineral resource. In general, it may also mean lower costs for the primary raw material depending on whether the discount granted by an ore-producing subsidiary to its parent steel-producing company is greater or less than a selling economy.[8]

Open-pit operations have decided advantages over underground mining. Since the ore is merely shoveled from the surface, less costly equipment is required than in deep mining. Furthermore, the open-pit mine gives greater flexibility in production. The degree of use of shovel machinery has an immediate effect on the volume of ore production; and with a small overhead cost, operations can be suspended entirely. This is in marked contrast to deep mining, where the initial investment is heavy, and operations can be curtailed or closed down only at considerable expense.

Moreover, direct-shipping ore—that is, ore of good quality that can be directly loaded and shipped without treatment—is decidedly preferable to concentrates. The use of ore which is of such poor quality that it must be treated before shipment involves additional costs and a consequent competitive disadvantage.[9]

[8] Through the 1940's, United States Steel's major ore subsidiary, Oliver Iron Mining Co., regularly sold ore to affiliated companies at an average discount of $0.25 per ton below the published price. Cf. L. Gregory Hines, The Lake Erie Iron Ore Market, American Economic Review, September 1951, p. 660.

[9] For a detailed discussion of the competitive advantages and disadvantages in the various mining operations, cf. pt. IV, pp. 85–87.

UNITED STATES STEEL CORP.

In 1948 United States Steel received 39.3 million gross tons of iron ore, or approximately 38 percent of the total receipts of 103.8 million gross tons consumed by all iron-ore users in the United States.

Practically all of the ore received by United States Steel was produced in this country. Of the total of 39.3 million tons, 31.5 million tons were produced from Lake Superior mines; 5.3 million tons came from Alabama, and 1.9 million tons from Utah. Only 409,000 tons, or about 1 percent of the total, were imported from foreign countries. Most of the foreign ores came from Brazil and Sweden.[10]

Virtually all of the ore from Lake Superior was consumed at facilities owned by United States Steel in three steel consuming districts—Pittsburgh-Youngstown, Cleveland-Detroit, and Chicago-Duluth. The output of 5.5 million tons from Alabama went to Tennessee Coal, Iron & Railroad Co. Geneva Steel Co. in Utah consumed the 1.9 million tons produced in that State.

The bulk of United States Steel tonnage came from mines of its Oliver Iron Mining Co. operating in the Lake Superior district. In 1948 this company alone produced 33.9 million tons, or about 41 percent, of the total production of 82.2 million tons in the Lake Superior district. Practically all of this was derived from open-pit operations and was direct-shipping ore.[11]

Oliver Iron Mining Co. obtains its ores from about 2 dozen operating properties in the Lake Superior district, most of them located in the Mesabi Range. Four mines in the Mesabi accounted for about 64 percent of the tonnage produced by the company in 1948. Two of these mines were the largest iron-ore producers in the United States; the other two were the fourth and seventh largest. All four are low-cost open-pit operations producing direct-shipping ore.[12]

In addition, United States Steel has iron-ore subsidiaries operating in Utah and Alabama. Columbia Iron Mining Co. in Utah produced 1.9 million tons of usable iron ore in 1948. The entire quantity was direct-shipping ore secured from open-pit operations. Tennessee Coal, Iron & Railroad Co. in Alabama produced for that year 4.9 million tons.[13] This output was from underground operations, but almost all of it constituted direct-shipping ore.

Both Columbia Iron Mining and Tennessee Coal, Iron & Railroad ship their entire production to United States Steel plants. A substantial portion of the very considerable production of Oliver Iron Mining Co. customarily is placed on the open market. In 1948 this amounted to 13.4 percent of the company's total shipments of 36.4 million tons, or about 4.9 million tons.[14]

United States Steel Corp. also has a financial interest in two other mining companies in the Lake Superior district. (See chart I.) It

[10] In 1948 United States Steel imported 240,000 tons from Brazil, 160,000 tons from Sweden, and 9,000 tons from Spain.

[11] Of the total production of 33.9 million tons, 31 million tons were open-pit. Only 2.8 million tons represented underground operations. About 30.9 million tons were direct-shipping; and only 3 million tons were in the form of concentrates.

[12] The shipments of these mines for 1948 were: Hull-Rust Mine, 9.9 million tons; Rouchleau, 5.9 million tons; Monroe-Tener, 2.5 million tons; Mountain Iron, 3.1 million tons.

[13] In addition, Tennessee Coal, Iron & Railroad Co. apparently purchased 500,000 tons in the open market for its mill operations.

[14] Oliver's report to FTC lists a total of 4.9 million tons of sales to other than affiliated companies. Benjamin F. Fairless, president of United States Steel, in his testimony before the House Subcommittee on the Study of Monopoly Power, put Oliver's sales for that year at 5.7 million tons (Celler committee hearings, serial No. 14, pt. 4-A (Steel), p. 562). The percentage computed above is based on the total furnished to FTC.

has a 21-percent interest in Mahoning Ore & Steel Co., which is managed by Pickands Mather & Co., operating agent. The Mahoning mine in the Mesabi is the third largest iron-ore mine in the United States. It is another open-pit operation producing direct-shipping ores; in 1948 the mine produced 3.9 million tons of iron ore. United States Steel's share in receipts from this production amounted to 820,000 tons.[15]

United States Steel is the second largest stockholder in Mahoning Ore & Steel. Bethlehem Steel has the controlling interest, with 51 percent of the stock ownership, and the remainder is divided among five other steel companies.[16]

United States Steel has an 11.9-percent interest in Montreal Mining Co., which is managed by Oglebay, Norton & Co.[17] The Montreal mine is the largest producing mine on the Gogebic Range, and one of the largest underground operations in the country. In 1948 it produced 1.1 million tons of direct-shipping ores. No shipments were made by this company to United States Steel in 1948.

Chart II graphically depicts United States Steel's ore supply situation in 1948. In order to facilitate comparisons as among the nine largest steel companies, the same scales have been used for each of the companies in presenting the data on their consumption of ore; in the case of United States Steel, this has necessitated "breaking" the grids on the charts. As will be seen from chart II, all of the ore consumed by United States Steel, except for small quantities, which were used in the southeastern district, came from its own mines.[18] Over 90 percent of the company's total production was direct-shipping ore, and approximately 81 percent was derived from open-pit operations.[19] In the Lake Superior district the advantages were even more pronounced. Ninety-two percent of Oliver's tonnage was direct-shipping ore, and a similarly high percentage represented operations from open-pit mines. Thus, the position of the largest steel company in the United States approximates closely the situation of maximum advantage described in earlier pages.

BETHLEHEM STEEL CORP.

The ore-consumption pattern of Bethlehem, the second largest steel corporation in this country, is in marked contrast to that of United States Steel. In 1948 Bethlehem's receipts of iron ore amounted to

[15] Almost all of the multiple owned ore-producing companies are so-called mutual companies; the annual production of ore is divided among owners on the basis of their stock interests, unless they elect not to take their full share of ore. In answering the Commission's questionnaire, Pickands Mather explained: "The various mining companies have contracts with their stockholders providing, among other things, for the sale by the company and the purchase by the stockholders, in proportion to their respective ownership percentages, of each year's production." In the few instances where the owners do not possess this claim upon annual production and the mine output is sold under contract, this fact is specifically noted in the text.

[16] Mahoning was one of the Great Northern properties. United States Steel acquired its 21-percent interest in Mahoning, then held by American Steel Hoop Co., at the time of its formation in 1901. Bethlehem acquired a one-half interest in Mahoning in 1923, in connection with the merger with the Midvale and Cambria steel companies. It purchased the remaining 1-percent interest in 1929. Republic's 6-percent interest extends back some 50 years. Youngstown had a 12-percent interest as early as 1923, and National acquired its 7-percent interest around 1930.

[17] E. W. Oglebay Co. owns 21 percent of the stock and David Z. Norton Co., 2.69 percent. These companies are not engaged in the iron and steel business. Another 18.11 percent is held by A. A. Welsh & Co., which is a nominee for a personal living trust. The balance of the stock is held in relatively small amounts by 30 or 35 individuals.

[18] Total purchases in that year amounted to 900,000 tons.

[19] Chart II, as well as the corresponding charts for the other major steel producers, shows the total ore consumed by the company, distributed between purchased ore and owned ore. The chart also shows the owned ore distributed in two ways: (*a*) direct-shipping versus concentrates and (*b*) open-pit versus underground. The companies did not furnish a breakdown of consumption by type of ore. However, they did furnish such breakdowns in terms of production. Hence, the figures shown on the charts were arrived at by applying the production breakdowns to the totals of owned ore consumption.

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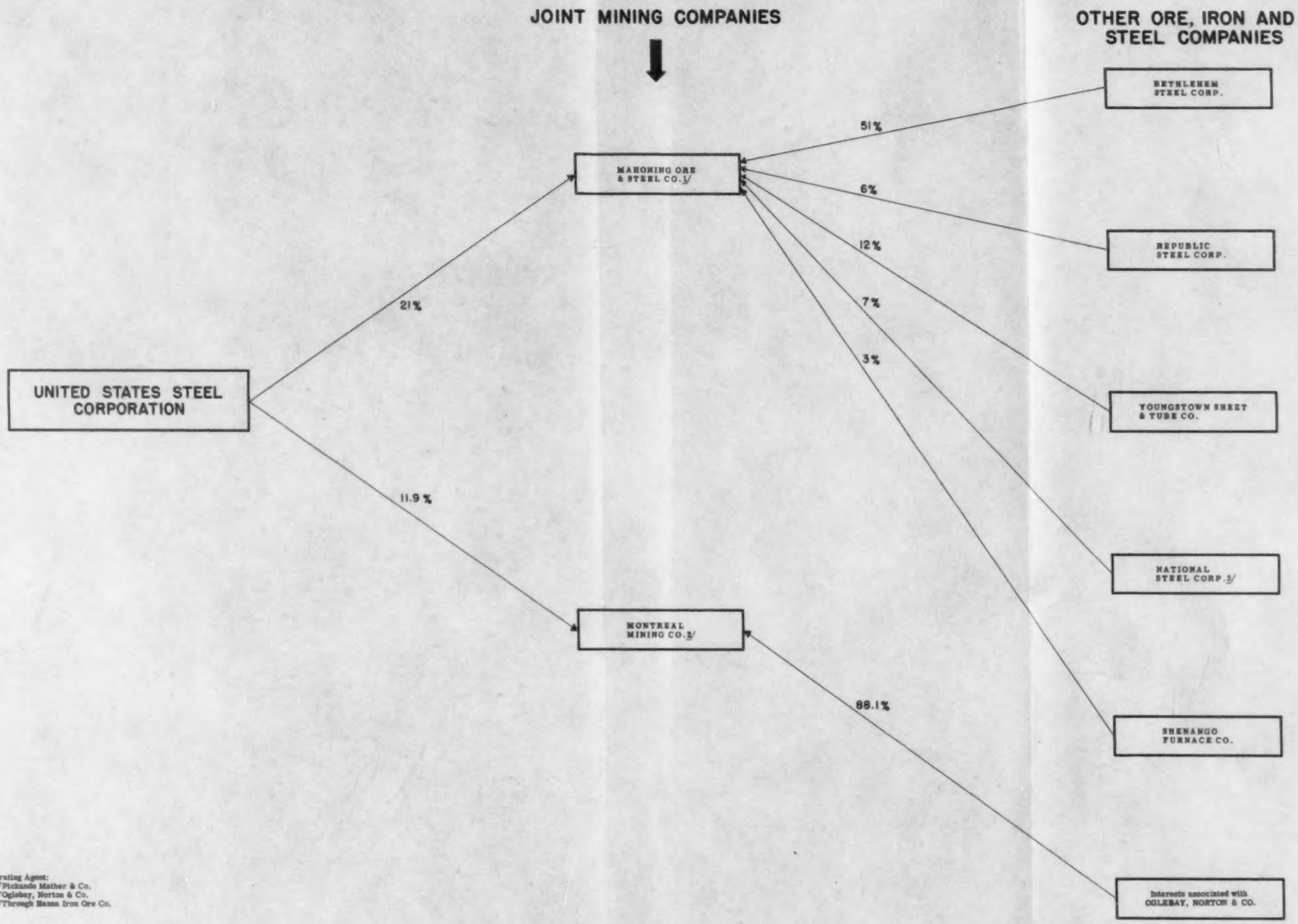
CHART I

JOINT OWNERSHIP OF MINING COMPANIES BY UNITED STATES STEEL CORPORATION AND OTHER ORE, IRON AND STEEL COMPANIES 1950



Operating Agent:
1/Pickands Mather & Co.
2/Oglebay, Norton & Co.
3/Through Hanna Iron Ore Co.

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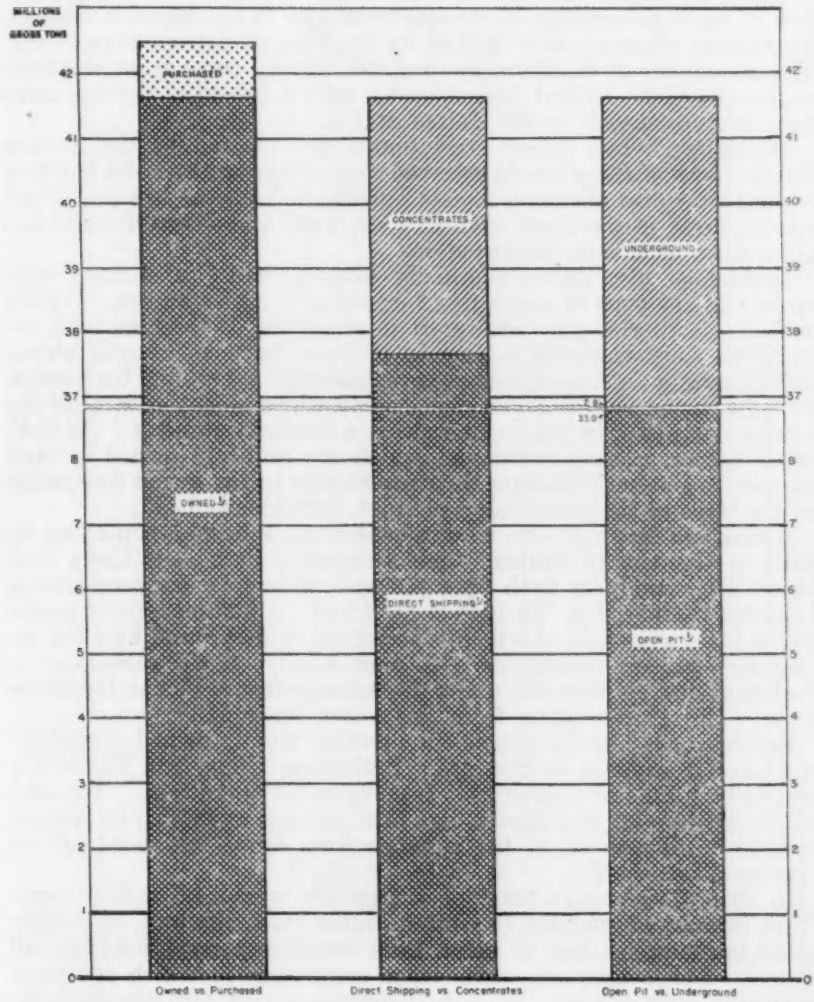
UNITED STATES STEEL
CORPORATION

CHART II

UNITED STATES STEEL CORP.

DISTRIBUTION OF CONSUMPTION OF IRON ORE, 1948



[1] Production from ownership interests includes sales of 4.9 million tons by Oliver Iron Mining Co. and may include exchanges of ore and changes in stockpiles.

14.6 million tons. Of this amount, only 7.3 million tons came from the Lake Superior region. Three million tons came from iron-ore mines elsewhere in the United States—2.1 million from Pennsylvania, 800,000 from New York, 60,000 from New Jersey, and very small quantities from Nevada and Utah.[20]

[20] Nevada contributed 5,000 tons and Utah 2,300 tons.

Another 4.3 million tons of iron ore came from abroad. By far the largest portion, 2.6 million tons, came from Chile; the next largest source was Sweden, which accounted for 1.2 million tons. The remainder came from Algeria, Spain, Tunisia, Cuba, and other countries.[21]

Thus, as contrasted with United States Steel, which received all but a small percentage of its ore from the Lake Superior district, Bethlehem obtained only half of its total supplies from that source. The remainder of Bethlehem's domestic supply came from scattered sources over the United States; and a very substantial portion came from sources outside of the United States.

Bethlehem's five major steel plants are located in the eastern district. All of these plants received some ore from the Lake Superior region; they also obtained sizable quantities from the less important mining areas in the East, such as New York and Pennsylvania; and all of them used some imported ore.

Bethlehem also differs markedly from United States Steel with respect to the type of companies furnishing it with iron ore. Wholly owned subsidiaries play little part in supplying Bethlehem with ore from the Lake Superior region; in its case, basic reliance is placed upon a number of miscellaneous investments in 20 mining companies. In some instances this investment constitutes majority control of the mining company; in others, it reflects a minority interest. As indicated earlier, mining companies which are multiply owned by steel companies generally allocate their production to the owner companies on the basis of the percentages of stock individually held.

Bethlehem has only one wholly owned ore subsidiary operated by itself in the United States. This company, Bethlehem-Cuba Iron Mines Co., conducts both open-pit and underground operations in Lebanon County, Pa. In 1948 it produced 1.1 million tons of usable ore, a little over half of which represented underground and the remainder open-pit operations. Another wholly owned subsidiary in the Lake Superior district is under the management of Pickands Mather & Co. However, supplies from this source are small.[22]

Bethlehem is heavily dependent upon its wholly owned subsidiary in Chile for supplies of iron ore. Bethlehem Chile Iron Mines Co. supplied 2.6 million tons in 1948 from open-pit operations. The ores are direct-shipping and have a high iron content, averaging 60 percent in 1948.[23] Almost all of the tonnage from Chile was used at the Sparrows Point plant.

In 1948 Bethlehem's receipts of iron ore were 14.6 million tons. Thus, in marked contrast to United States Steel, the bulk of Bethlehem's ore supplies had to come from companies outside of its full control. Large amounts came from companies in which it shares ownership with others. To a considerable extent this situation reflects the earlier development of the industry during which ore reserves were concentrated in a few hands. Since Bethlehem only belatedly took an interest in the acquisition of domestic reserves because of its

[21] Algeria accounted for 292,000 tons; Spain, 95,000 tons; Tunisia, 28,000 tons; Cuba, 1,600 tons; and miscellaneous other sources, 20,000 tons.

[22] Sunday Lake Iron Co. in Michigan shipped a half million tons in 1948.

[23] The higher the iron content, other things remaining equal, the greater the yield in the blast-furnace process. In the determination of the Lake Erie selling price for iron ore, a content of 51.5 percent iron natural is accepted as standard, and additions and subtractions to the price are made, depending on whether the ore has a higher or lower iron content. For a detailed discussion of the Lake Erie iron-ore-price determination, cf. Minnesota Mining Directory, 1950, p. 235.

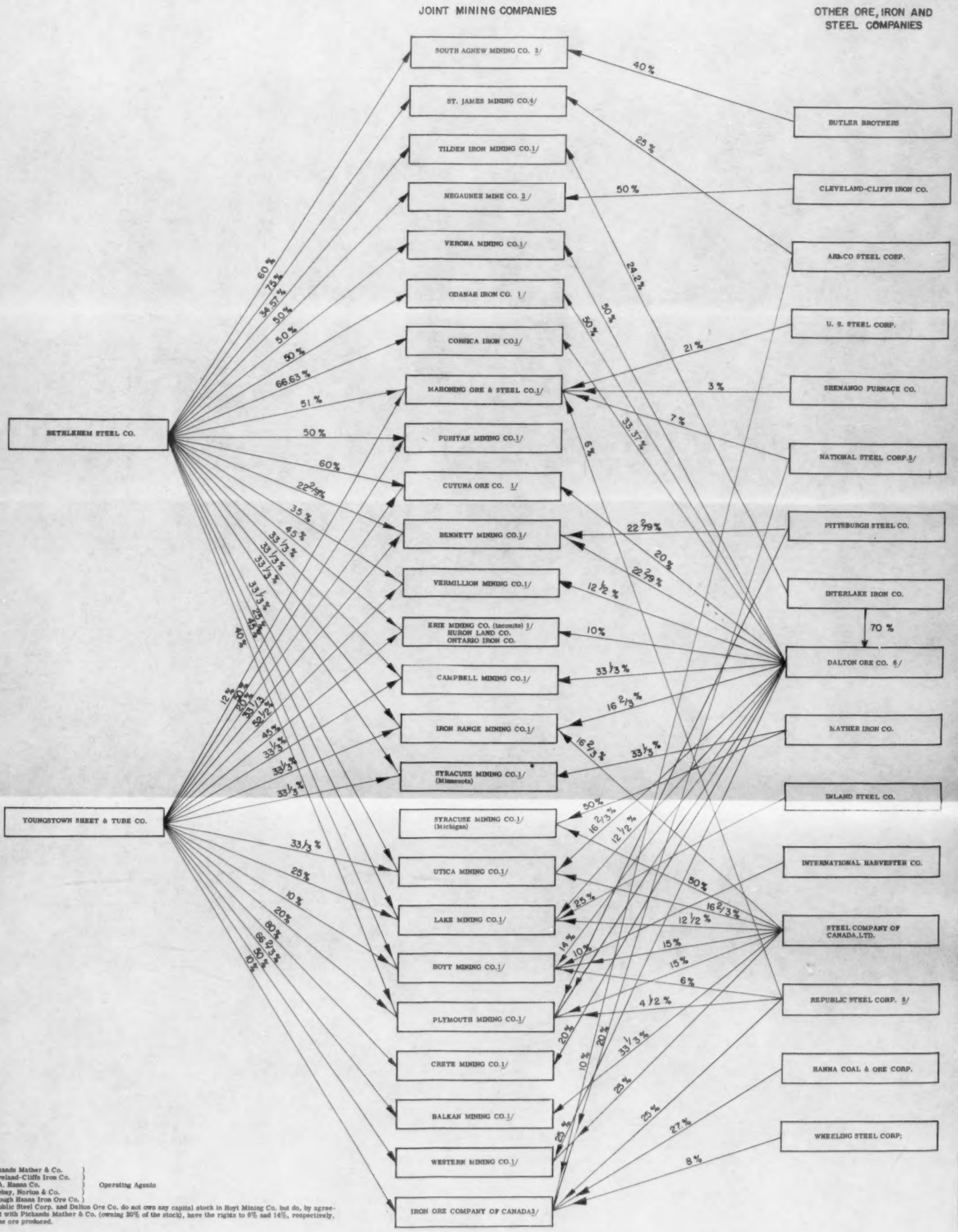
BETHLEHEM STEEL CORP.
YOUNGSTOWN SHEET AND TUBE CO. AND OTHER
ORE, IRON AND STEEL COMPANIES

CHART III.

JOINT OWNERSHIP OF MINING COMPANIES BY BETHLEHEM STEEL CORP.,

CHART III.

JOINT OWNERSHIP OF MINING COMPANIES BY BETHLEHEM STEEL CORP., YOUNGSTOWN SHEET AND TUBE CO., AND OTHER ORE, IRON AND STEEL COMPANIES 1950



1/Pickands Mather & Co.)
2/Cleveland-Cliffs Iron Co.)
3/M. A. Hanna Co.) Operating Agents
4/Oglebay, Norton & Co.)
5/Through Hanna Iron Ore Co.)
6/Republic Steel Corp. and Dalton Ore Co. do not own any capital stock in Hoyt Mining Co. but do, by agreement with Pickands Mather & Co. (owning 20% of the stock), have the rights to 6% and 14%, respectively, of the ore produced.

JOINT OWNERSHIP OF MINING COMPANIES BY BETHLEHEM STEEL CORP., YOUNGSTOWN SHEET AND TUBE CO. AND OTHER ORE, IRON AND STEEL COMPANIES

1950

confidence in its Cuban ore, it, perforce, has had to rely upon stock acquisitions in existent mining companies to provide necessary supplies of iron ore.

The complex structure of Bethlehem's participation in the ownership of 20 mining companies is shown in chart III. Seventeen of these companies are managed by Pickands Mather. In 1948 Pickands Mather shipped to Bethlehem 5.1 million tons of iron ore, all from the Lake Superior region. The 3.8 millions tons from Minnesota were almost entirely direct-shipping ores derived from open-pit operations. The 1.3 million tons from Michigan and Wisconsin were largely direct-shipping ores, but represented underground operations. In both cases the ore averaged an iron content of between 51 and 52 percent.[24]

Chart III reveals a conspicuous four-way tie-up in the ownership of ore mines among Bethlehem, Youngstown Sheet & Tube, certain affiliates of Pickands Mather & Co., and Steel Co. of Canada. All of the mines owned jointly by these four interests are operated under a management contract by Pickands Mather & Co.; and, in accordance with established practice, the participating owners obtain ore equivalent to their respective ownership interests.

Bethlehem and Youngstown share in the ownership of 13 ore companies. In the case of 10 of these, partial ownership is held by Dalton Ore Co., closely affiliated with Pickands Mather. Mather Iron Co., all the common stock of which is owned by Pickands Mather, shares the ownership of one of the companies in which Bethlehem and Youngstown are interested. In addition, Bethlehem is joined with Dalton Ore in the ownership of three other ore-mining companies, and with Interlake Iron—another Pickands Mather affiliate—in a fourth company. Bethlehem also holds controlling interests in St. James Mining Co. and South Agnew Mining Co.

Open-market purchases

Bethlehem differs from United States Steel in that the supply of ore received as a consequence of all of these ownership ties is not adequate for its needs. United States Steel produces more than enough for its requirements; and customarily a substantial portion of the output of Oliver Iron Mining Co., United States Steel's largest mining subsidiary, enters the open market.

Bethlehem is not so fortunate. In 1948 Bethlehem obtained 1.1 million tons from its wholly owned and operated domestic mines; 5.1 million tons from Pickands Mather, arising out of Bethlehem's stock interests in mining companies managed by that ore house; and another 730,000 tons from its stock interests in companies managed by Hanna and Cleveland-Cliffs Iron Co. Altogether, this amounted to 7 million tons received from these sources in the United States. In addition, Bethlehem received 2.6 million tons from its wholly owned subsidiary in Chile. This made a total of 9.6 million tons received by Bethlehem from all sources, domestic and foreign, arising out of ownership connections.

From other sources, Bethlehem had to procure another 5 million tons for its mills in 1948. A good share of this tonnage came from imports. In 1948 Bethlehem purchased 1.6 million tons from foreign

[24] In 1948 Bethlehem received ore from two other companies as a result of its ownership connections. It received 690,000 tons of ore from the Negaunee mine, managed by Cleveland-Cliffs Iron Co. This was an underground operation located in Michigan; its ore reserves were exhausted in April 1949. Bethlehem also received about 40,000 tons from South Agnew Mining Co., managed by the Hanna interests. This mine, located on the Mesabi, engaged in both open-pit and underground operations.

countries.[25] The remaining 3.2 million tons came from purchases within the United States, either on long-term contracts or in spot purchases. Bethlehem has long-term buying arrangements with all of the major ore houses other than Pickands Mather. Reports to the Commission show that, through the early 1950's, it has long-term contracts to purchase ore from Butler Bros. and Hanna Coal & Ore Corp.—both associated with the Hanna group—as well as from Cleveland-Cliffs Iron Co., and Oglebay, Norton. Such commitments have helped Bethlehem to fill the gap between the amount supplied by companies in which it has ownership interests and the total amount consumed at the Bethlehem steel plants.

Chart IV summarizes the situation of Bethlehem in 1948. Approximately two-thirds of its ore was obtained on the basis of ownership, and one-third from domestic and foreign purchases. Direct-shipping ore accounted for 87 percent of the production from ownership interests; and only 67 percent of this production was derived from open-pit operations. No data are available to show the breakdown, by type of ore, for the purchases of Bethlehem in that year. It is clear, however, that, as compared with United States Steel, Bethlehem was at a decided disadvantage with respect to its ore supplies.

REPUBLIC STEEL CORP.

In 1948 Republic Steel, the third largest steel company in the United States, received 8.9 million tons of iron ore. This represented 8.7 percent of the total amount of iron ore consumed in this country during that year.

Of this total, all but 200,000 tons came from domestic sources. A substantial amount, 6.2 million tons, originated in the Lake Superior region. New York State contributed 1.4 million tons, and lesser amounts were supplied by Alabama, Georgia, Tennessee, and New Jersey.[26] Republic's only imports, 236,000 tons, came from Canada. All of this ore was consumed in nine plants distributed among five consuming districts.

On a geographic basis the Lake Superior region accounted for 1.2 million tons. Republic's mines in Michigan shipped to affiliated steel plants 850,000 tons—all direct-shipping ores produced from underground operations, averaging 50.6 percent in iron content.[27] Its Minnesota mines supplied 348,000 tons of concentrates from open-pit operations. The ore averaged 48.3 percent in iron content.

The largest single tonnage from Republic's mines originated in New York. In 1948 these mines supplied the steel company with 1.3 million tons, all from underground operations. All but a small portion of this ore was shipped in sinter form [28] with an average iron content of 66 percent.[29]

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[25] As indicated earlier, 1.3 million came from Sweden and most of the remainder from Algeria, Spain, Tunisia, and Cuba.

[26] The amounts were as follows: Alabama, 638,000 tons; Georgia, 363,000; Tennessee, 33,000; and New Jersey, 14,000.

[27] Actual production from Republic's mines in Michigan amounted to 1 million tons. According to Republic's report, about 162,000 tons were shipped to others "under exchange agreements for approximate equivalent market value of ores from other mines" (Report to FTC).

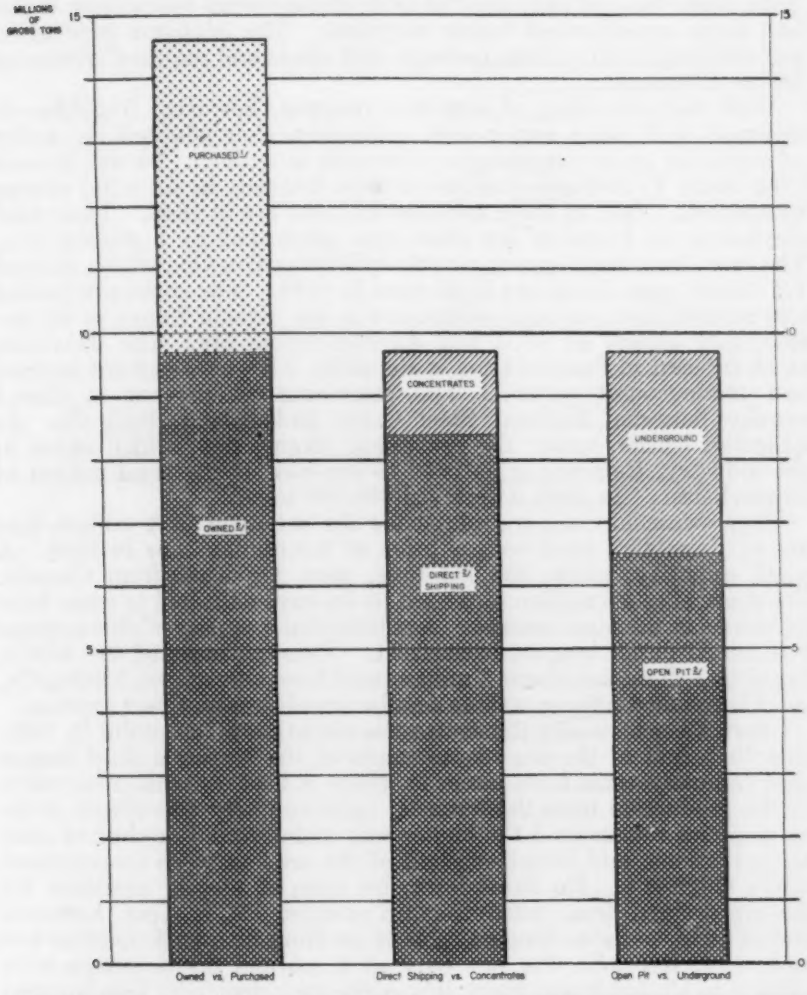
[28] Sinter is iron ore in fine particles which must be agglomerated with the help of a binder to become suitable blast-furnace material.

[29] In 1948, some 20,000 tons from the New York mines were shipped to others. Republic reported that, at the time of acquiring the New York mines, certain sales commitments of the predecessor companies were assumed by Republic. These tonnage commitments were being liquidated rapidly.

CHART IV

BETHLEHEM STEEL CORP.

DISTRIBUTION OF CONSUMPTION OF IRON ORE, 1948



[1] Purchases represent the difference between production from ownership interests and total ore consumed. Purchases may also include exchanges of ore and changes in stockpiles.
[2] Includes production from Bethlehem's Chilean properties.

The Alabama mines of Republic supplied 497,000 tons in 1948. This ore was all produced from underground operations. Approximately two-fifths were direct-shipping ores, but the iron content was low, averaging only 31.6 percent. The remainder was shipped as sinter; and, after treatment, the iron content averaged 49 percent.

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As compared with United States Steel, it is clear that Republic was also at a decided disadvantage. The bulk of the ore supplies secured from Lake Superior were direct-shipping, but were derived from the higher-cost underground mining operations. The average iron content was also lower than that of United States Steel's mines in the Lake Superior district. Republic's biggest tonnage from New York State was not only derived from underground operations; it also had to be concentrated before shipment. The Alabama production was similarly derived from underground mines and required treatment before shipment.

With the dwindling of domestic reserves, however, Republic—in common with other major steel companies—has adopted the policy of acquiring mining companies or buying into them. As will be seen from chart V, Republic has investment interests in six other mining companies. Four of them contributed some ore in 1948. Their total shipments to Republic for that year amounted to 1 million tons. The most important source was Susquehanna Ore Co., which shipped 1.3 million tons of iron ore to all users in 1948. The entire production was secured from open-pit operations in the Mesabi Range in Minnesota, and almost all of it was direct-shipping ore. The dominant stock interest in Susquehanna is Republic, with a 50-percent interest and management control. The remaining 50 percent is shared equally between National Steel Corp. and Inland Steel Co. As indicated earlier, under the prevailing arrangement which exists in the industry, Republic is entitled to one-half of the total output of Susquehanna. In 1948 it received 600,000 tons.[30]

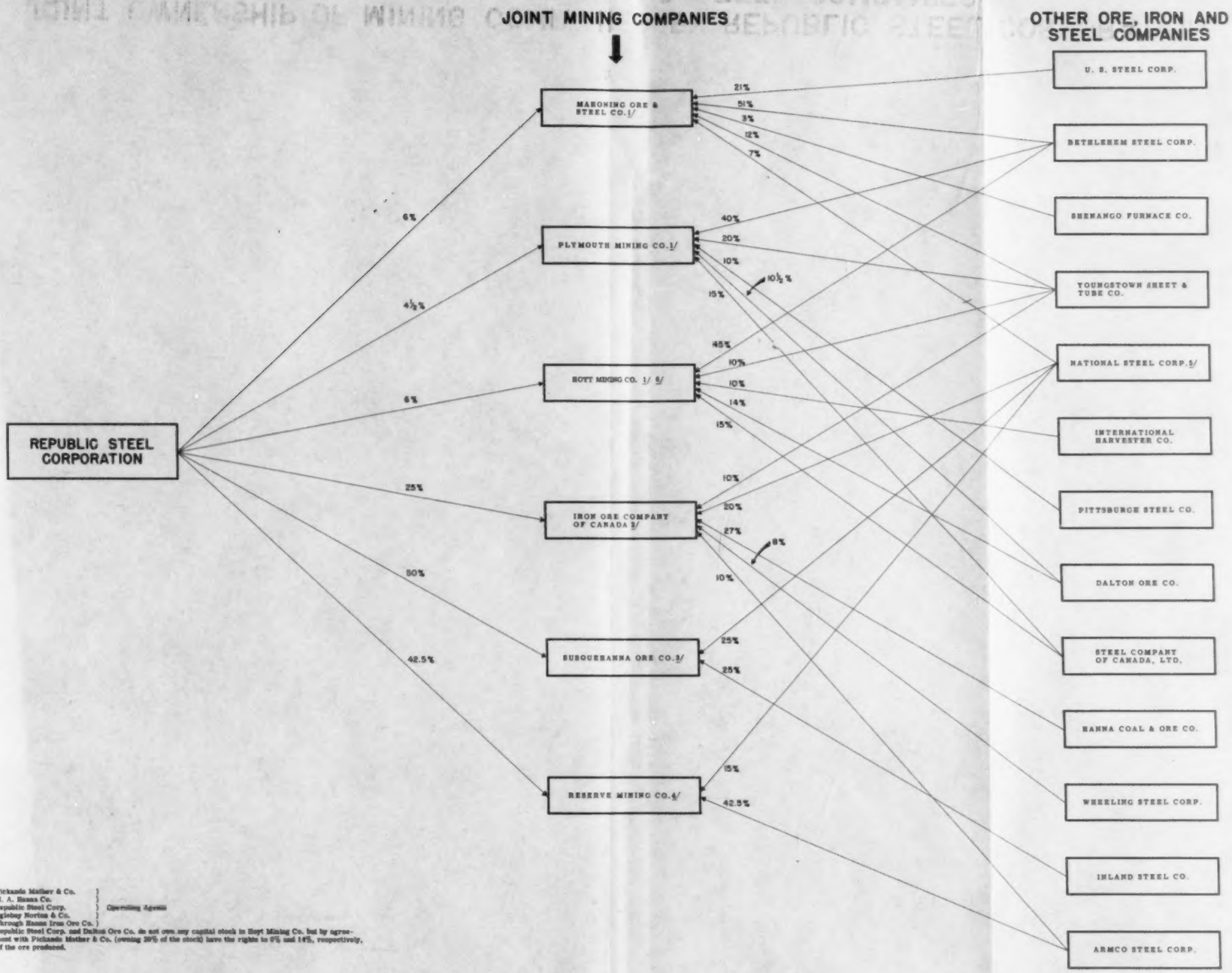
Thus ownership ties accounted for the shipment of 4 million tons out of Republic's total consumption of 8.9 million tons in 1948. A small quantity, about 235,000 tons, were imported from Canada. The remaining 4.6 million tons used by its steel mills had to come from purchases in the open market. A substantial quantity of this tonnage was mined under long-term contract. Through most of the 1950's, Republic will receive about 3 million tons from Oliver Iron Mining Co. and Cleveland-Cliffs, as well as smaller supplies from other sources.

Chart VI graphically illustrates the situation of Republic in 1948. Less than half of the ore requirements of the Nation's third largest steel company came from mines in which it held ownership interests. Of the production from these mines, approximately two-thirds of the ore supplies represented the higher-cost underground method of mining operations, and about one-half of the ore had to be concentrated before shipment. No breakdown, by type of ore, is available for the ore derived from nonownership sources. It is clear, however, that in 1948, so far as consumption of ore from its own properties was concerned, Republic was not only at a marked disadvantage with relation to United States Steel; it was also very decidedly handicapped as compared with Bethlehem, which itself rated well below United States Steel relative to ore supplies.

[30] Republic also has a minority interest in two ore companies managed by Pickands Mather and receives a share of the ore produced by a third company under the same management. Its 6-percent interest in Mahoning Ore & Steel Co., owner of the third largest producing mine in the United States, entitled Republic to 6 percent of this mine's production of 3.9 million tons in 1948. Actual receipts amounted to 250,000 tons. Republic also received 27,000 tons from its 4.5-percent interest in Plymouth Mining Co. and 137,000 tons, representing 6 percent of the production of Hoyt Mining Co., to which it has the right under an agreement with Pickands Mather, owner of 20 percent of Hoyt's stock. All three of the mines in question, located in the Lake Superior region, are open-pit operations, producing direct-shipping ore of good quality. Two other companies shown in the chart V, Iron Ore Co. of Canada and Reserve Mining Co., were not engaged in production in 1948.

CHART V.

JOINT OWNERSHIP OF MINING COMPANIES BY REPUBLIC STEEL CORPORATION AND OTHER ORE, IRON AND STEEL COMPANIES 1950



1/Pickands Mather & Co. }
2/M. A. Hanna Co. }
3/Republic Steel Corp. } Operating Agents
4/Oglebay Norton & Co. }
5/Through Hanna Iron Ore Co.
6/Republic Steel Corp. and Dalton Ore Co. do not own any capital stock in Hoyt Mining Co. but by agreement with Pickands Mather & Co. (owning 20% of the stock) have the rights to 6% and 14%, respectively, of the ore produced.

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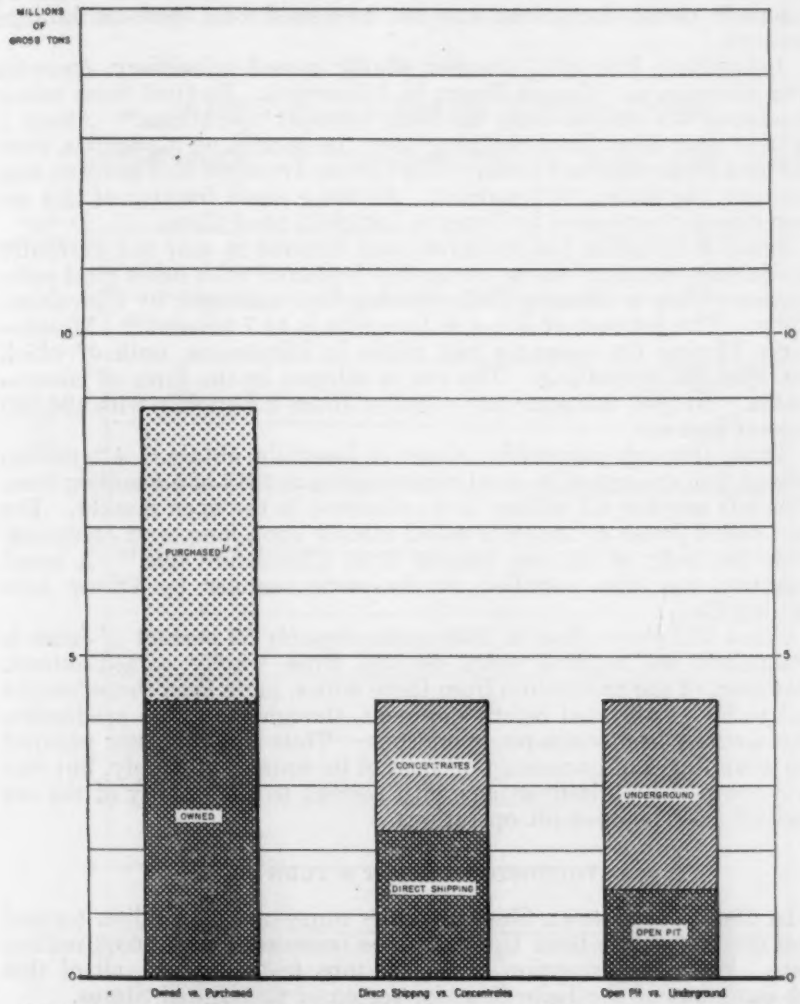
CHART VI

REPUBLIC STEEL CORP.

DISTRIBUTION OF CONSUMPTION OF IRON ORE, 1948



[1] Purchases represent the difference between production from ownership interests and total ore consumed. Purchases may also include exchanges of ore and changes in stockpiles.

JONES & LAUGHLIN STEEL CORP.

In 1948 Jones & Laughlin consumed 5.5 million tons of iron ore at its three steel plants. All of this ore was domestic in origin; and with the exception of 756,000 tons from New York, all came from the Lake Superior region. Approximately 4.6 million tons were produced on the Mesabi and Cuyuna Ranges in Minnesota, and the remaining 244,000 tons on the Marquette and Gogebic Ranges in Michigan.

A substantial portion of the ore used by Jones & Laughlin came from its wholly owned mines. Jones & Laughlin Ore Co., a wholly owned subsidiary, controls the Benson mine, an open-pit operation in New York. In 1948 this mine produced 810,000 tons of iron ore, the bulk of it in sinter form and a small amount as concentrates. About 756,000 tons went to affiliated steel plants; the remainder went to others.[31] After treatment the ore averaged 64.3 percent in iron content.

Inter-State Iron Co., another wholly owned subsidiary, operates five mines in the Mesabi Range in Minnesota. In 1948 these mines produced 3.3 million tons, all from open-pit operations.[32] About 1 million tons were direct-shipping ores; the remaining 2.3 million were shipped in concentrate form. The former averaged 50.9 percent iron content; the latter, 53.5 percent. All but a small fraction of this ore was directly consumed by Jones & Laughlin Steel Corp.

Jones & Laughlin has an investment interest in only one currently producing company whose ownership is shared with other steel companies. This is Mesaba-Cliffs Mining Co., managed by Cleveland-Cliffs. The interest of Jones & Laughlin is 11.7 percent.[33] Mesaba-Cliffs Mining Co. operates two mines in Minnesota, both of which are open-pit operations. The ore is shipped in the form of concentrates. In 1948 this company supplied Jones & Laughlin with 194,000 tons of iron ore.

Thus, through ownership, Jones & Laughlin obtained 4.2 million tons of iron ore out of its total consumption in 1948 of 5.5 million tons. This left another 1.3 million to be obtained in the open market. For this deficit Jones & Laughlin relied mainly upon long-term contracts, with the bulk of the ore coming from Cleveland-Cliffs.[34] A small quantity was also supplied in the same manner by Oliver Iron Mining Co.

Chart VII shows that in 1948 approximately 80 percent of Jones & Laughlin's ore supplies were derived from wholly owned sources. However, of the production from these mines, more than three-fourths had to be beneficiated before shipment, though the entire production was secured from open-pit operations. Thus the company enjoyed the advantages of ownership of most of its sources of supply, but was at a competitive disadvantage with respect to the quality of the ore derived from its open-pit operations.

YOUNGSTOWN SHEET & TUBE CO.

In 1948 Youngstown Sheet & Tube consumed 5.3 million tons of iron ore out of the total United States consumption of 103.8 million tons. With the exception of 79,000 tons from Canada, all of this ore came out of the Lake Superior region of the United States.

This company has five steel plants, three of which are located in the Pittsburgh-Youngstown district and two in the Chicago-Duluth dis-

[31] The company reported that this was "for experimental purposes, etc."

[32] In 1948 the Hill Annex mine shipped 1.7 million tons; the Columbia mine shipped 506,000 tons. This production—together with that from the Grant, Longyear & Sullivan No. 2 mines—totaled 3.2 million tons.

[33] Cleveland-Cliffs is the largest stockholder in Mesaba-Cliffs, owning 32.2 percent of the stock. Other holders of stock are Pittsburgh Steel Co., 16 percent; Wheeling Steel Corp., 15.2 percent; Inland Steel Co., 14.2 percent; and Hanna Iron Ore Co., 10.7 percent.

[34] The steel company also owns some undeveloped properties jointly with Cleveland-Cliffs Iron Co. Jones & Laughlin Ore Co. owns 75 percent of the capital stock of Lucky Star Mining Co., 31.9 percent of Bunker Hill Mining Co., and 50 percent of Arctic Iron Co., undeveloped properties in Michigan. In each of these companies Cleveland-Cliffs owns the balance of the stock.

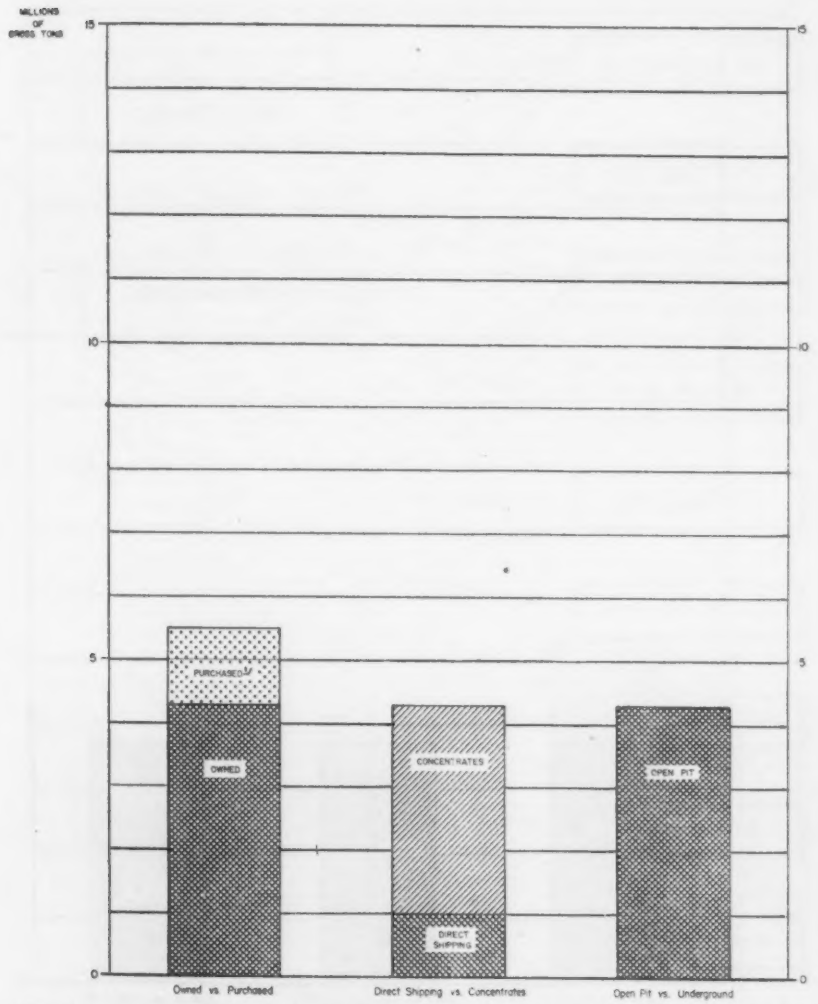
trict. All five are well located in terms of their present ore supply from the Lake Superior region.

The company obtained 3.7 million tons, out of its total of 5.3 million tons, through Pickands Mather. All of the ore supplied by this managing agent came as the result of direct ownership ties held by Youngstown. Approximately 2.4 million tons were produced in Minnesota, most of which were direct-shipping ores from open-pit

CHART VII

JONES & LAUGHLIN STEEL CORP.

DISTRIBUTION OF CONSUMPTION OF IRON ORE, 1948



[1] Purchases represent the difference between production from ownership interests and total ore consumed. Purchases may also include exchanges of ore and changes in stockpiles.

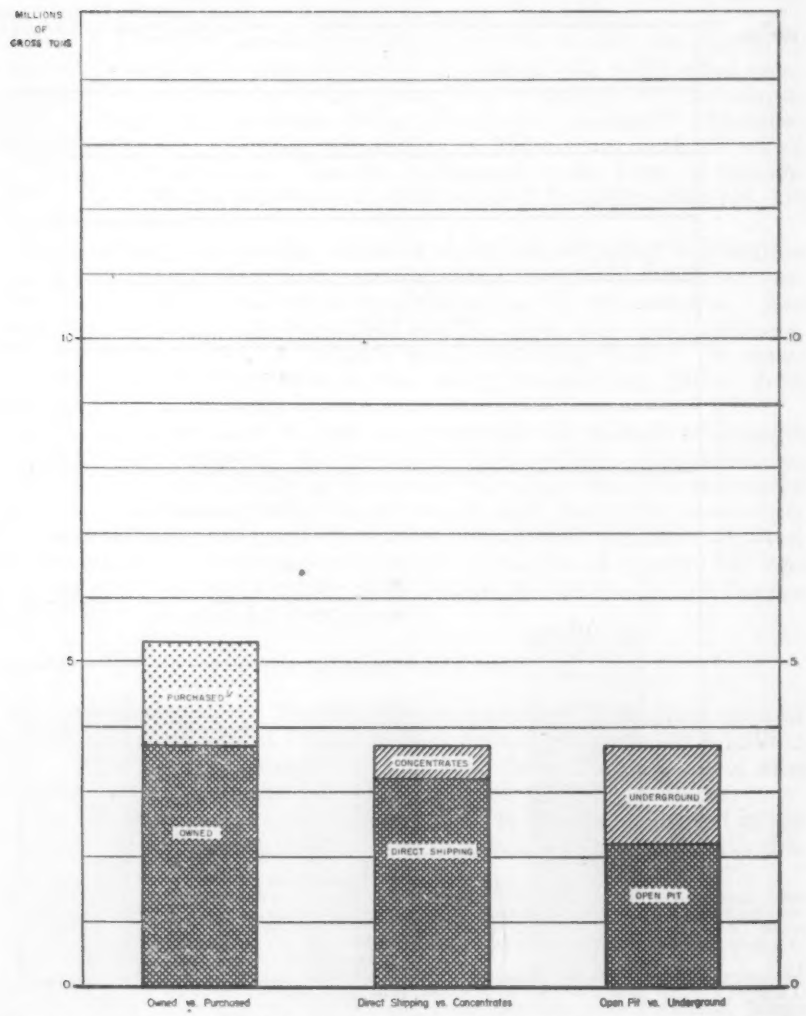
operations. The remaining 1.3 million tons came from Michigan and Wisconsin, and were largely direct-shipping ores arising from underground mining. The average iron content of the ore in the former case was 51 percent, and in the latter, 51.7 percent.

The remaining 1.6 million tons, with the exception of 79,000 tons from Canada, came from purchases in the domestic market. Many of these purchases are currently handled through long-term contracts.

CHART VIII

YOUNGSTOWN SHEET & TUBE CO.

DISTRIBUTION OF CONSUMPTION OF IRON ORE, 1948

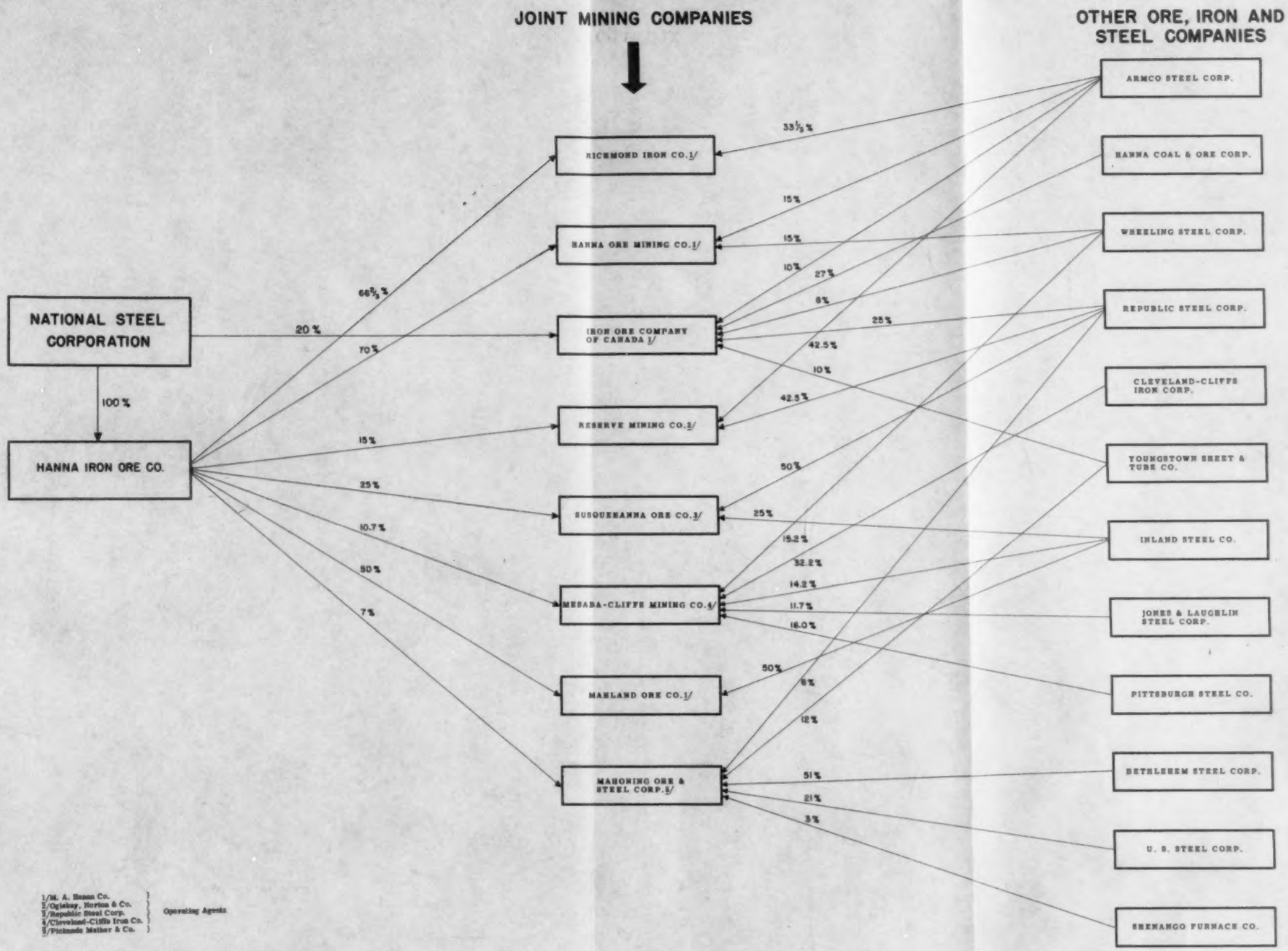


[1] Purchases represent the difference between production from ownership interests and total ore consumed. Purchases may also include exchanges of ore and changes in stockpiles.

CHART IX.

JOINT OWNERSHIP OF MINING COMPANIES BY NATIONAL STEEL CORPORATION AND OTHER ORE, IRON AND STEEL COMPANIES

1950



1/M. A. Hanna Co.
2/Oglebay, Norton & Co.
3/Republic Steel Corp.
4/Cleveland-Cliffs Iron Co.
5/Pickands Mather & Co.
} Operating Agents

On the basis of its long-term contract, Youngstown will be able to secure, until the mid-fifties, large supplies of ore from Cleveland-Cliffs Iron Co. and Oliver Iron Mining Co., United States Steel's mining subsidiary.

Chart VIII summarizes the iron-ore-supply picture of Youngstown in 1948. Approximately 70 percent of its ore was obtained through ownership interests; and of this production, about 89 percent constituted direct-shipping ore. However, little more than half came from open-pit operations, while the remainder was produced from the more costly underground mining operations.

NATIONAL STEEL CORP.

In 1948 the ore receipts of National Steel amounted to 4.5 million tons, practically all of which originated in the Lake Superior region. The only other source of ore for National was 48,000 tons imported from Canada.

Approximately 80 percent of the ore received by National came from mines managed by its affiliate, M. A. Hanna Co. M. A. Hanna Co. is the largest single stockholder in National, owning 27 percent of National's capital stock. In addition, it received 7 percent of its supply from mines operated by Republic, 6 percent from Pickands Mather, and 4 percent from Cleveland-Cliffs. In all three of these cases National has ownership interests in the mining companies which accounted for these shipments.

National owns the entire capital stock of Hanna Iron Ore Co., which is made up of 4,000 shares of common stock having a par value of $25 per share. In 1948 Hanna Iron Ore supplied National with nearly 2 million tons of iron ore. Approximately 1.1 million tons came from open-pit operations in Minnesota; little less than a half of this quantity was direct-shipping ore. The ore averaged 48.6 percent in iron content. Another 886,000 tons came from underground operations in Michigan, all direct-shipping ore.

Chart IX shows the interlocking ownership in mining companies shared by National with other firms in the steel industry. Four of these companies are under the management of Hanna. National received ore from only one of them in 1948.[35]

National has a 25-percent interest in Susquehanna Ore Co., an open-pit operation on the Mesabi Range. On the basis of this investment, National received about 320,000 tons of ore. It has a 7-percent interest in Mahoning Ore & Steel Co., one of the three largest open-pit mines on the Mesabi, and received 269,000 tons of iron ore from this source. Its 10.7-percent interest in Mesaba-Cliffs Mining Co., also on the Mesabi, yielded another 176,000 tons in 1948.

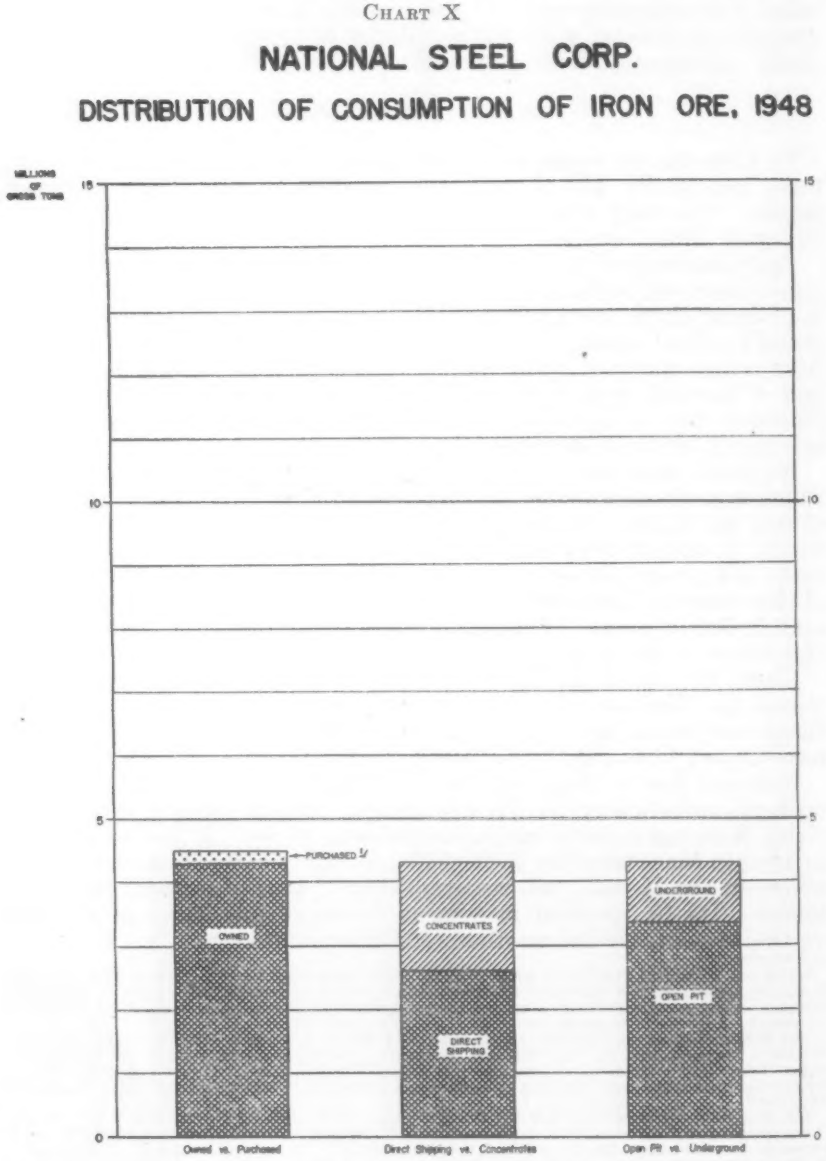
[35] This was Richmond Iron Co., in which National has a 66⅔-percent interest. The remaining interest is held by Armco. In 1948 Richmond Iron produced 134,000 tons of a high-silica ore used for specialized purposes. Because of the character of the ore, the tonnage has not been included in the statistical data in this report. Approximately 100,000 tons of the company's production went to National.

The other companies are Mahland Ore Co., and Iron Ore Co. of Canada. National has a 50-percent interest in Mahland, with the other half held by Inland. The report on Mahland to this Commission states: "There is no commercial ore now known to exist on these properties. However, iron formation is present and there is the possibility that exploration and development work might prove that commercial ores exist."

The other company involved is Iron Ore Co. of Canada. National holds directly a 20-percent interest in the company, and Hanna Coal & Ore holds another 27 percent. Thus the Hanna interests control 47 percent of the stock in Iron Ore Co. of Canada. Other interested units are steel companies—Republic with 25 percent; Youngstown, 10 percent; Armco, 10 percent; and Wheeling, 8 percent. The company was formed in 1949 for the purpose of financing the development of ore deposits in the Labrador-Quebec area. Another new mining company, Hollinger-Hanna, Ltd., equally owned by Hollinger Consolidated Gold Mines, Ltd., and Hanna, was formed to supervise management of the operations.

From all of these ownership connections, National received a total of 4.3 million tons of iron ore. This figure almost equaled its consumption of 4.5 million tons in 1948.[36] Furthermore, production of all of this ore was centered in the Mesabi; and chart X shows that 80 percent was derived from open-pit operations and 60 percent was direct-shipping ores. In short, National appears to be the most

CHART X

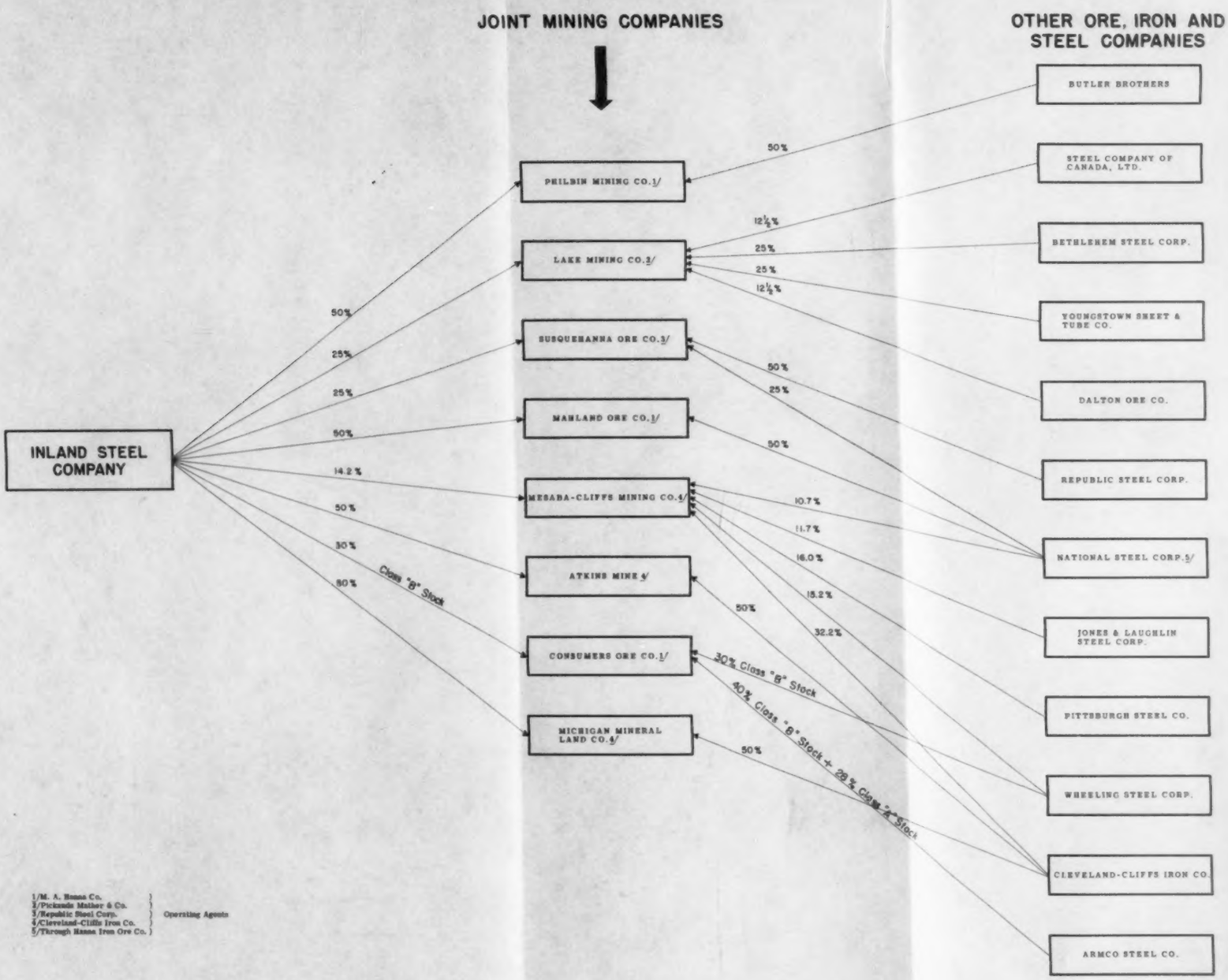


1/ Purchases represent the difference between production from ownership interests and total ore consumed. Purchases may also include exchanges of ore and changes in stockpiles.

[36] Only 200,000 tons remain to be accounted for. As indicated earlier, National received about 50,000 tons imported from Canada. This leaves about 150,000 tons which it obtained through open-market purchases.

CHART XI.

JOINT OWNERSHIP OF MINING COMPANIES BY INLAND STEEL COMPANY AND OTHER ORE, IRON AND STEEL COMPANIES 1950



1/M. A. Hanna Co.
2/Pickands Mather & Co.
3/Republic Steel Corp.
4/Cleveland-Cliffs Iron Co.
5/Through Hanna Iron Ore Co.
Operating Agents

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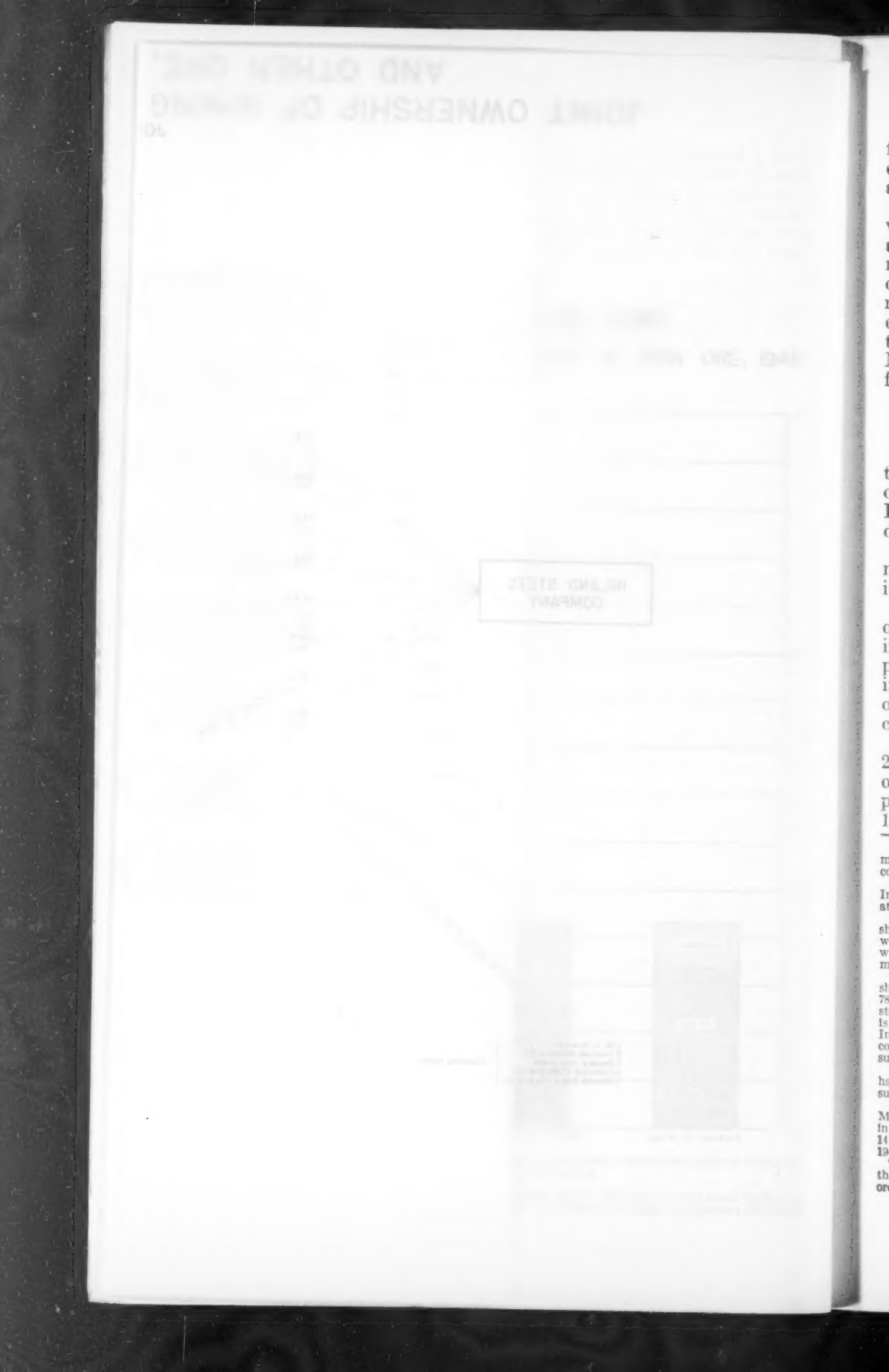


favorably situated, with the single exception of United States Steel, of all the steel companies with respect to ownership of its ore sources and low-cost operations.

Basically, this favorable position is the result of its close affiliation with the Hanna complex of ore companies. In 1948 the Hanna group accounted for a production of 10.3 million tons. Of this, approximately 3.6 million tons were shipped to National Steel Corp. Because of the close relationship existing between them, Hanna has customarily reserved its choicest and lowest-cost ore for National. In addition, the extensive Hanna ore-mining properties serve as a bulwark of security to National for the future. Unlike some of the major steel companies, National has not found it necessary to engage in a continuous search for ore reserves inside the United States and abroad.

INLAND STEEL CO.

Inland's total receipts of iron ore in 1948 amounted to 4.6 million tons. All of this ore, with the exception of 135,000 tons from Canada, originated in the Lake Superior region. The ore was consumed at Inland's one plant located at Indiana Harbor, Ind., in the Chicago district.

Approximately one-quarter of Inland's ore came from captive mines. All of this ore was of direct-shipping quality, but the bulk of it came from underground operations.[37]

Another 1.3 million tons came from mines in which it shared ownership with others. As is shown on chart XI, Inland has partial interests in eight mining companies. Four of these companies supplied ore to Inland in 1948, all of them operating on the Mesabi Range in Minnesota. The ore shipped by them to Inland was from open-pit operations, over two-thirds was direct-shipping ore, and the iron content averaged about 48 percent.[38]

In all, only a little over half of Inland's total tonnage, approximately 2.4 million tons out of 4.6 million, came from mines with which it had ownership ties. In consequence, a large amount of ore had to be purchased in the open market. As indicated earlier, Inland imported 135,000 tons from Canada in 1948. This left a little over 2 million

[37] An underground operation in the Cuyuna Range shipped 236,000 tons, all direct-shipping ore. Approximately 148,000 tons went to the parent company. The ore from this range averaged 49 percent in iron content.

Two mines in the Menominee Range in Michigan produced a total of 500,000 tons, all of which went to Inland. The ores from these mines were direct-shipping, derived almost entirely from underground operations, and averaged about 52 percent iron.

Two other mines in the Marquette Range in Michigan supplied another 440,000 tons. These were direct-shipping ores from underground operations, with the ore averaging 51.5 percent iron. Another 51,000 tons were shipped to Inland from the Mesabi Range in Minnesota. This was open-pit, direct-shipping ore, with an iron content of 49 percent. Thus, altogether, Inland received from its own mines a total of 1.1 million tons of iron ore in 1948.

[38] One of these sources was Philbin Mining Co., in which Inland has a half interest. In 1948 Philbin shipped to Inland 306,000 tons. The remaining interest in the mining company is held by Butler Bros., 78.5 percent of whose stock is in the hands of Consumers Ore Co., a holding company. In turn, the class B stock of Consumers Ore (on which claims to ore from the company's mining properties apparently are based) is owned by three steel companies: Inland, with 30 percent; Armco, 40 percent; and Wheeling, 30 percent. Inland also shares equally with National Steel in the ownership of Mahland Ore Co., although its properties contain no known commercial ore. Five of these companies—Philbin, Butler Bros., National Steel, Consumers Ore, and Mahland—fall within the orbit of the Hanna group.

Inland also owns 50-percent interest in Atkins Mine and in Michigan Mineral Land Co. The remaining half in each instance is owned by Cleveland-Cliffs, which manages these properties. In 1948 Atkins Mine supplied Inland with 282,000 tons of iron ore. Michigan Mineral Land Co. is not an operating property.

Inland has a minority interest in three other mining companies. It has a 25-percent interest in Lake Mining Co., which supplied Inland in 1948 with 285,000 tons of usable ore. It also has a 25-percent interest in Susquehanna Ore Co., whose shipments to Inland amounted to 33,000 tons of usable ore in 1948. Inland's 14.2-percent investment in Mesaba-Cliffs Mining Co. gave the steel company 135,000 tons of usable ore in 1948.

The company stated that the difference between total shipments to which the company is entitled and the actual shipments to it may represent tonnages sold or shipped to other companies in exchange for their ore.

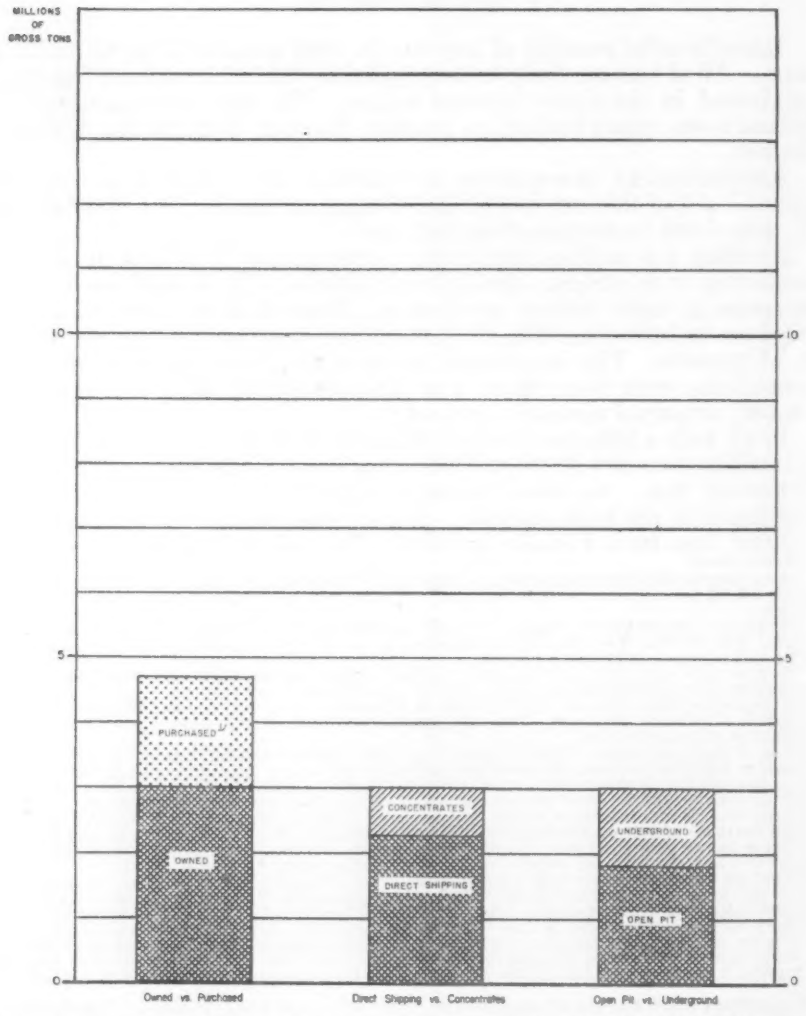
tons to be purchased domestically in the open market. A substantial proportion of this ore came from the Hanna companies and Cleveland-Cliffs through long-term contractual arrangements.

Chart XII shows that, in 1948, Inland obtained nearly two-thirds of its ore as the result of ownership connections. A little over three-quarters of this production was direct-shipping ore, and about 60 percent came from open-pit operations.

CHART XII

INLAND STEEL CO.

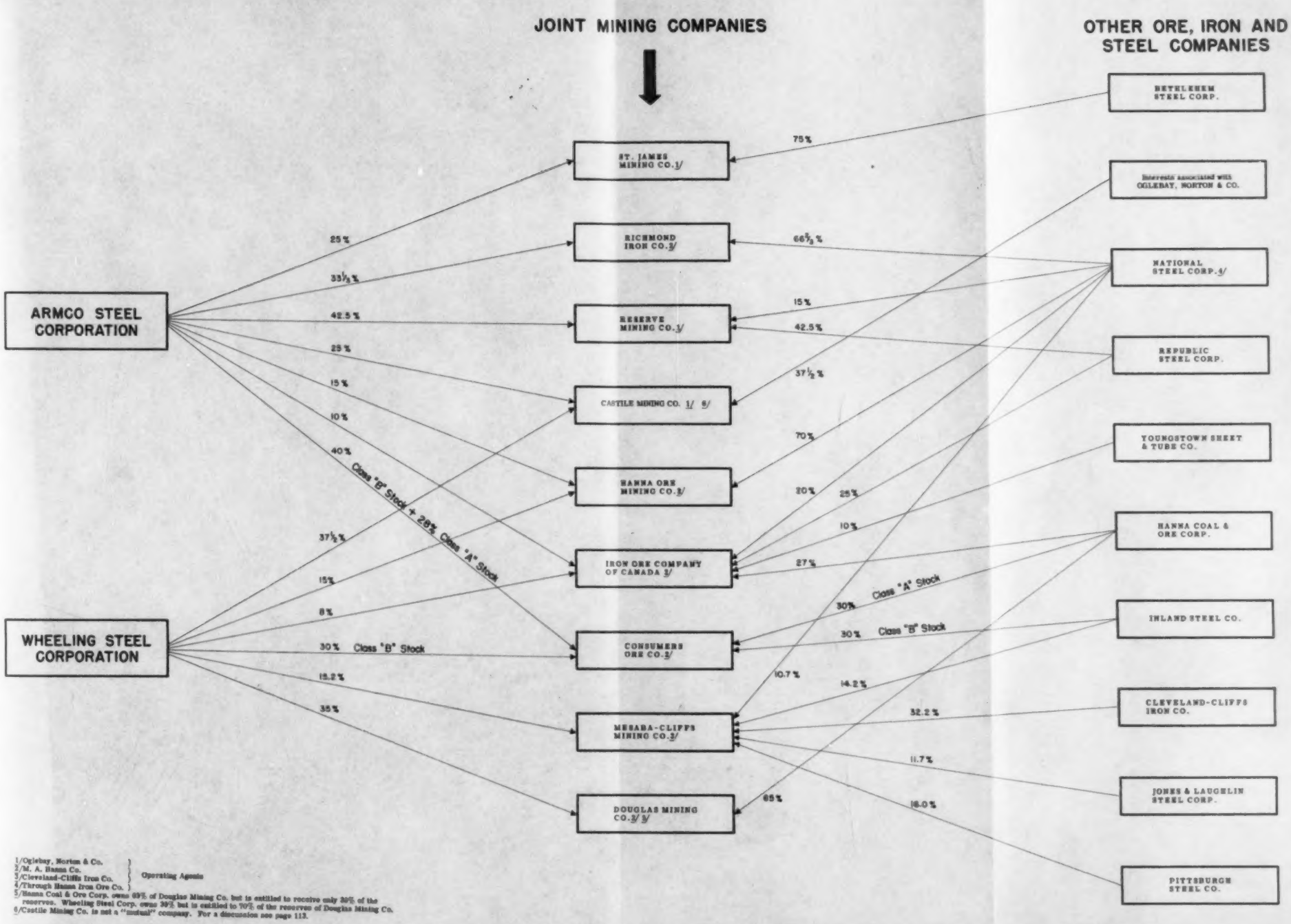
DISTRIBUTION OF CONSUMPTION OF IRON ORE, 1948



[1] Purchases represent the difference between production from ownership interests and total ore consumed. Purchases may also include exchanges of ore and changes in stockpiles.

CHART XIII.

JOINT OWNERSHIP OF MINING COMPANIES BY ARMCO STEEL CORPORATION, WHEELING STEEL CORPORATION AND OTHER ORE, IRON AND STEEL COMPANIES 1950



1/Oglebay, Norton & Co.
2/M. A. Hanna Co.
3/Cleveland-Cliffs Iron Co. } Operating Agents
4/Through Hanna Iron Ore Co.
5/Hanna Coal & Ore Corp. owns 69% of Douglas Mining Co. but is entitled to receive only 30% of the reserves. Wheeling Steel Corp. owns 30% but is entitled to 70% of the reserves of Douglas Mining Co.
6/Castile Mining Co. is not a "mutual" company. For a discussion see page 113.

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ARMCO STEEL CORP.

Armco's receipts of iron ore amounted to 2.4 million tons in 1948. This ore came from a variety of sources both in the United States and abroad.

Approximately 2.2 million tons were domestic in origin. Of this amount, 1.9 million tons came from the Lake Superior district. About 272,000 tons originated in Texas; 39,000 in New Jersey, and 1,500 in Tennessee. The remaining 160,000 tons were foreign ores. The largest amount, 150,000 tons, came from Mexico; another 9,000 came from Brazil and 1,400 from Canada.

Chart XIII shows the interlocking ownership of mining companies with Wheeling and others. However, only a small amount of Armco's total receipts of 2.4 million were derived from ownership ties with such mining companies. Armco had no wholly owned iron-ore mines in 1948; and, in each of the three instances where it obtained ore through ownership connections, Armco held only minority interests in the mining companies. One of them is under Oglebay, Norton management; the other two are associated with the Hanna interests.

Armco obtained 206,000 tons in 1948 from Castile Mining Co., managed by Oglebay, Norton. This company produced 450,000 tons of iron ore on the Gogebic Range in the Lake Superior region, all direct-shipping ore from underground operations, averaging 52.7 percent in iron content.[39] On the basis of its stock interest in Castile, Armco was entitled to approximately 100,000 tons; as noted above, it actually received 206,000 tons. The Commission was informed by one of the stock owners in this company that Castile was not a "mutual" company; that is, the ore was not prorated among owning steel companies on the basis of their investment interests. Unlike the usual practice, all ore was sold under contract by the mining company.[40]

Armco has a 15-percent interest in Hanna Ore Mining Co., 70 percent of whose stock is held by Hanna Iron Ore Co., which in turn is wholly owned by National Steel Corp. On the basis of its investment, Armco was entitled to approximately 360,000 tons in 1948. It actually received about 298,000 tons.[41] It received another 11,000 tons of iron ore from Butler Bros., also in the Hanna orbit.[42]

From all of these sources, Armco obtained 504,000 tons of iron ore in 1948. This represented less than a quarter of its total receipts of 2.4 million tons in that year. Another 160,000 tons were imported, leaving approximately 1.7 million tons to be procured from domestic sources in the open market. A substantial portion of these open-market purchases represented long-term contracts with the Hanna interests, with which Armco is closely allied. In the immediate future the steel company will receive some ore from Hanna Coal & Ore Corp., some from Oglebay, Norton and some from Oliver Iron Mining Co.

[39] Ownership of the preferred stock in Castile is as follows: Armco, 25 percent; Wheeling Steel Corp., 37½ percent; E. W. Oglebay Co., 25 percent; and David Z. Norton Co., 12½ percent. Armco and Wheeling hold the same percentage of common stock, with the remainder divided among E. W. Oglebay Co., David Z. Norton Co., and estate of Crispin Oglebay.

[40] Chart XIII also shows for Armco a 25-percent interest in St. James Mining Co. and a 50-percent interest in Reserve Mining Co., both properties under the management of Oglebay, Norton. The properties were under development in 1948 and shipped no ore.

The total reserves of Castile Mining Co., as of January 1, 1949, were reported to the Commission by Oglebay, Norton, managing agent, to be 681,000 tons; and the approaching exhaustion of the company's mine was noted. Sometime before April 26, 1951, Castile had ceased to operate (Listing Statements of the New York Stock Exchange, A-13782, Wheeling Steel Corp., April 26, 1951; prospectus of April 26, 1951, p. 44).

[41] Differences between a company's share of production and what it actually received may be represented by ore sold or shipped to other companies in exchange for their ore.

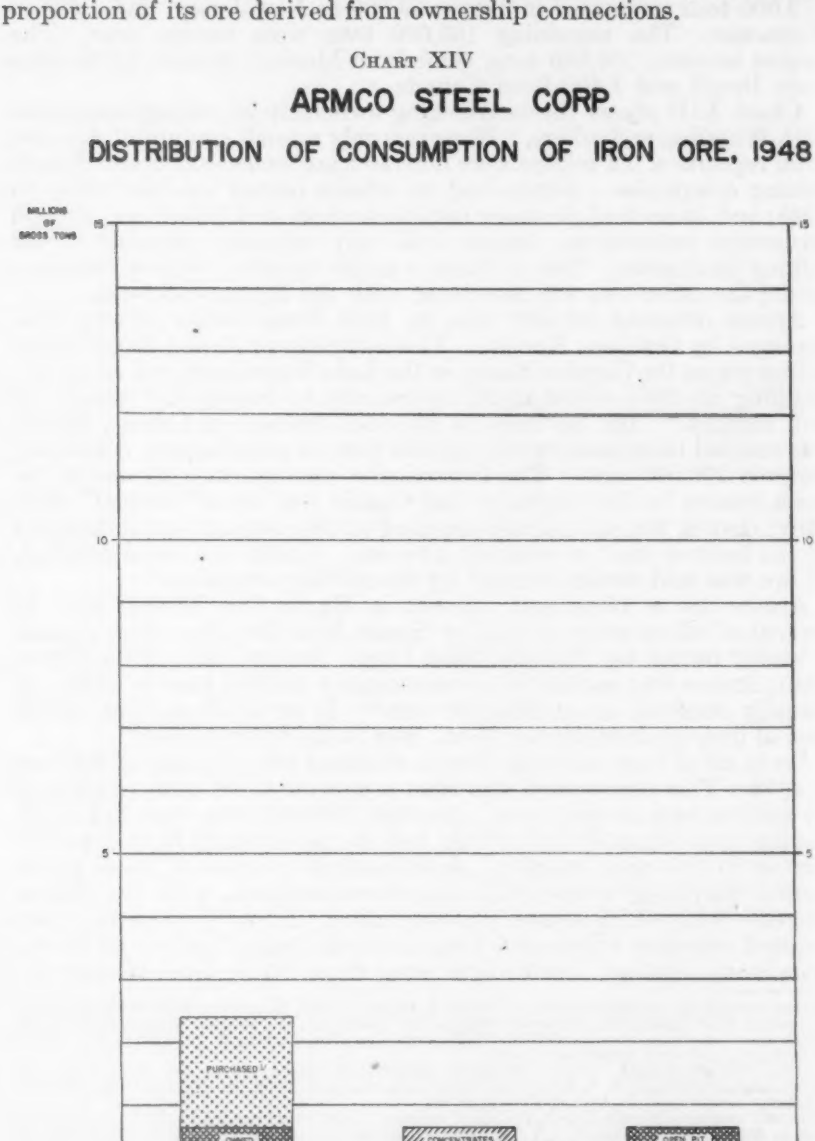
[42] Though Armco has a 33⅓-percent interest in Richmond Iron Co., the production from this interest is not included in Armco's receipts since Richmond produces a specialty ore.

Chart XIV illustrates the ore supply picture for Armco in 1948. Only one-fourth of the ore consumed came from ownership sources. Of this production, the entire supply was derived from open-pit operations, although two-thirds of it had to be concentrated before shipment. This situation represents a marked contrast to that of National and to several of the other steel companies previously examined. Of all the companies studied, Armco ranked lowest with respect to the proportion of its ore derived from ownership connections.

CHART XIV

ARMCO STEEL CORP.

DISTRIBUTION OF CONSUMPTION OF IRON ORE, 1948



[1] Purchases represent the difference between production from ownership interests and total ore consumed. Purchases may also include exchanges of ore and changes in stockpiles. Also, excludes Armco's share of the production of Castile Mining Co.

WHEELING STEEL CORP.

In 1948 Wheeling's receipts amounted to nearly 1.9 million tons of iron ore. Approximately 1.7 million tons originated in the Lake Superior region. Another 80,000 tons came from New York, with the balance of 97,000 tons imported from Canada.

Approximately 1.4 million tons came from sources in which Wheeling has stock investments. The steel company had in 1948 only one wholly owned operating property. This was the Wacootah mine, which supplied 223,000 tons in 1948. It was an open-pit operation in the Mesabi.[43]

Chart XIII shows six mining companies with which Wheeling is interlocked with other steel companies through ownership ties. In 1948 Wheeling received some ore from four of these mining companies. It obtained 226,000 tons from Castile Mining Co., managed by Oglebay, Norton. Wheeling has a 37½-percent interest in Castile, which for many years supplied direct-shipping ores from underground operations in the Lake Superior region.[44]

The largest amount of ore came from companies having ownership ties with the Hanna group. Wheeling received 367,000 tons of iron ore from Hanna Ore Mining Co., in which it has a 15-percent stock interest. The tonnage allocated to Wheeling represented its approximate share based on its investment. Another 367,000 tons came from Douglas Mining Co., also managed by Hanna.[45] Finally, Wheeling obtained 250,000 tons from Mesaba-Cliffs Mining Co., in which it has a 15.2-percent interest. From these ownership arrangements, Wheeling derived 1.4 million tons out of its total receipts of 1.9 million tons. All of the ore received originated in the Lake Superior district. There remained approximately half a million tons to be obtained from other sources. Approximately 100,000 tons were imported from Canada; the balance came from open-market purchases.

Most of the ore received by Wheeling outside of its ownership connections is through long-term contracts. The steel company's close ties with Hanna, through stock interests in Hanna ore companies, are further cemented by long-term contractual arrangements with Hanna Coal & Ore Corp. Wheeling also gets some ore from Cleveland-Cliffs Iron Co., with which it is associated, along with other steel companies, in ownership of Mesaba-Cliffs Mining Co. It has bought ore from Oliver Iron Mining Co., both spot and on contract.

Wheeling's consumption of ore is graphically shown in chart XV. Approximately two-thirds of its supply came from sources with which it had ownership connections. All of the ore from these sources was derived from open-pit operations, although over 60 percent had to be concentrated before shipment.

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[43] Cf. Wheeling's 1951 annual report (p. 8): "The Wacootah iron ore mine, operated by the corporation for many years under a lease, was abandoned late in 1951, the remaining iron-ore reserves being inadequate to permit a profitable operation. The lease was assigned and the facilities were sold to an unaffiliated corporation."

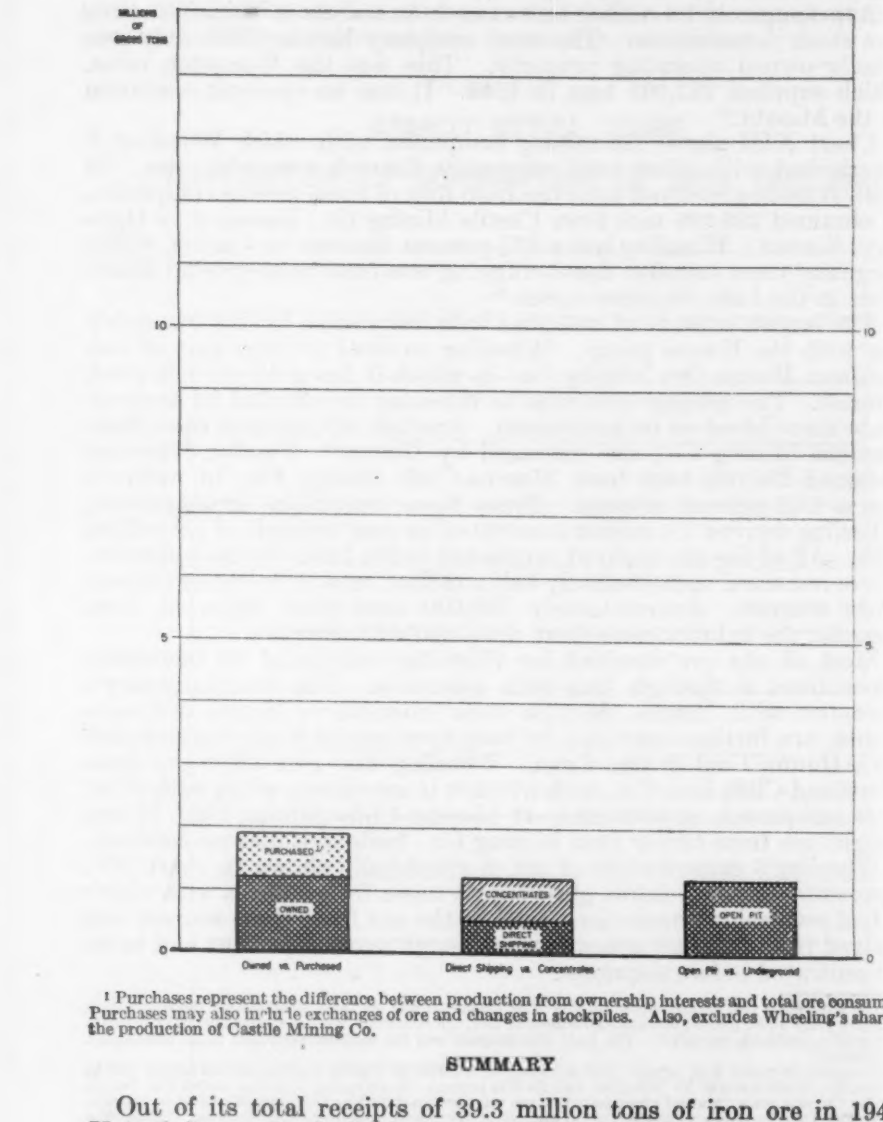
[44] It should be noted that Armco with a 25-percent interest in Castile, received 206,000 tons in 1948 as against the 226,000 received by Wheeling with its 37½ percent. In its report Wheeling stated that Castile Mining Co. was not a "mutual" company; that ore was purchased under contract by Wheeling and others.

[45] In 1948 Douglas produced 533,000 tons of iron ore in Minnesota from open-pit operations. About two-thirds of the ore was shipped as concentrates; the remainder, as direct-shipping ore. Wheeling has a 35-percent interest in the company, but is entitled to 70 percent of its ore reserves. The remaining 65-percent stock interest is held by Hanna Coal & Ore Corp. The tonnage shipped to Wheeling by Douglas Mining Co. represents a substantial increment over the allotment due it on the basis of its stock interest in the company.

CHART XV

WHEELING STEEL CORP.

DISTRIBUTION OF CONSUMPTION OF IRON ORE, 1948



[1] Purchases represent the difference between production from ownership interests and total ore consumed. Purchases may also include exchanges of ore and changes in stockpiles. Also, excludes Wheeling's share of the production of Castile Mining Co.

SUMMARY

Out of its total receipts of 39.3 million tons of iron ore in 1948, United States Steel obtained 38.4 million tons from its own mines, which was derived as follows: 30.7 million tons from Oliver Iron Mining Co.; 4.9 million tons from Tennessee Coal, Iron & Railroad Co., and 1.9 million tons from Columbia Iron Mining Co. It received a little less than a million tons from Mahoning Ore & Steel, roughly its

share of production arising out of its stock ownership in the company.[46] Virtually all of these receipts were direct-shipping ore and, with the exception of the Alabama production by Tennessee Coal & Iron, all were produced from open-pit operations. Only 900,000 tons of ore were obtained outside of ownership connections, and approximately half of this constituted specialty ores from abroad.

Bethlehem, the second-largest company, received 14.6 million tons of iron ore in 1948. Approximately 3.7 million tons came from wholly owned properties—1.1 million tons from domestic sources and 2.6 million tons from Chile. Another 5.9 million tons came from domestic mines in which Bethlehem has ownership interests but which are managed by the ore merchants. Pickands Mather, the most important of these to Bethlehem, shipped 5.2 million tons from the Lake Superior district; M. A. Hanna supplied 43,000 tons, and Cleveland-Cliffs, 692,000 tons. The balance of 5 million tons represented purchases.[47] Approximately one-third of this amount constituted imports; the remainder was purchased within the United States. Unlike United States Steel, substantial amounts of the ore obtained by Bethlehem came from underground operations, though most of it was direct-shipping ore.

Republic, the third-largest company, had receipts totaling 8.9 million tons in 1948. Approximately 3 million tons came from wholly owned mines in New York, Michigan, Minnesota, and Alabama. Most of this ore was from underground operations in these areas, and considerable quantities were concentrated before shipment. Another 1,000,000 tons came from mines in which it shared ownership with others. Susquehanna Ore Co., operated by Republic, supplied 600,000 tons of open-pit, direct-shipping ore from the Lake Superior region; another 415,000 tons came from mines operated by Pickands Mather in which Republic has minority investment interests. The remaining 4.9 million tons had to be purchased in the open market. With the exception of a small quantity imported from Canada, all of this tonnage was obtained within the United States.

Jones & Laughlin used 5.5 million tons in 1948, of which 4 million tons came from its own mines. All of this ore was derived from open-pit operations, but most of it had to be treated before shipment. Another 194,000 tons came from Cleveland-Cliffs as a result of Jones & Laughlin's interest in Mesaba-Cliffs Mining Co. This ore was also from open-pit mines and was concentrated before shipment. The remaining 1.2 million tons used by the steel company in 1948 were purchased in the domestic market.

Youngstown Sheet & Tube's entire receipts of 5.3 million tons came from mines operated by others. Like Bethlehem, its largest single source was Pickands Mather, which contributed 3.7 million tons, all derived from investment interests held by the steel company in mines managed by the ore house. Most of this tonnage was direct-shipping ore, and about two-thirds came from open-pit operations. Another 1.7 million tons were purchased almost entirely from sources within the United States.

Inland received 4.6 million tons in 1948. Approximately 1.1 million tons came from its own mines in the Lake Superior district

[46] United States Steel's 21-percent stock ownership in Mahoning entitled it to approximately 820,000 tons out of the company's total production of 3.9 million tons. Apparently, however, the 820,000 tons were included in the statistics of production by Oliver Iron Mining Co. in its report.

[47] Small quantities of ore were also exchanged among steel companies. Since these amounts cannot be segregated, they were included in the figure for purchases.

and was almost entirely direct-shipping ore. Another 1.3 million tons came from mines in which it shared ownership with others; this tonnage was shipped in approximately equal quantities by the three largest ore merchants. Except for a small amount of imports, the remaining 2.2 million tons used by Inland was purchased within this country.

The remaining three of the nine largest steel companies—National, Armco, and Wheeling—are all more or less closely associated with the Hanna interests. This is particularly true of National, the largest block of whose stock is held by M. A. Hanna Co. In 1948 approximately 80 percent of the 4.5 million tons of ore received by National came from mines operated by the Hanna group. Most of this ore was from open-pit operations, and substantial quantities were of direct-shipping quality. Most of the balance came from mines not identified with the Hanna interests but in which National has investments.

Of Armco's total receipts of 2.4 million tons, only 500,000 tons came from mines in which it has stock investments. The shippers of this ore were M. A. Hanna and Oglebay, Norton. Except for a small quantity of imports, the remaining 1.9 million tons were purchased in the United States. In contrast, Wheeling received 1.4 million tons, out of its total receipts of 1.9 million tons, from ownership connections in mining properties. Hanna was the largest supplier, with small quantities coming from Cleveland-Cliffs, Oglebay, Norton, and mines operated and owned by itself. Most of the deficit was made up by purchases in the domestic market.

THE SMALLER USERS OF IRON ORE

The Commission did not send questionnaires to the smaller integrated steel companies, to the independent merchant iron producers, or to companies which, while they operated blast furnaces and had no steel-making facilities, were partially "captive" or only quasi-independent. The residual status in the industry of these users of iron ore should be evident, however, from the preceding discussion of the nine largest steel companies. The bulk of the country's ore is pledged to the nine largest users, either through direct ownership of mining properties or long-term contracts with the merchant ore houses. This ore, "captive" in one form or another, comprises the country's richest deposits currently under exploitation; and it constitutes the lowest-cost and highest quality ore now being produced in the United States. Thus the smaller users are, with respect to iron-ore supplies, at a decided competitive disadvantage.

Certain of these users have, since 1948, appreciably improved their positions through negotiation of long-term contracts with suppliers who have been participating in the development of foreign ore properties and who evidently believe their hopes to be approaching realization. But it does not follow that, in this changed situation, semi-integrated steel companies and other buyers of pig iron will generally be better off, since the open-market supply of pig appears to be contracting. Although certain of the smaller integrated steel companies which have lately become assured of substantial iron ore supplies for a number of years in the future have recently increased or contemplate increasing their blast furnace capacity, they have at the same time added, or are about to add, ingot capacity. Utilization of these steel-making facilities will thus leave little surplus pig iron

to be disposed of to others. Merchant furnaces with long-term commitments to purchase ore may wish, or at least be willing to make long-term contracts to supply pig iron to selected buyers. Such contracts are likely to be with larger and financially stronger customers; and to the extent that such contracts are multiplied, so will be the difficulties of the numerous consumers of pig iron whose resources permit no more than short-term contracts, or perhaps only frequent spot purchases.

But because the competitive disabilities of the small users of pig iron are more conspicuous, one should not overlook the fact that the smaller users of iron ore who have achieved a temporary security in the matter of ore supply have done so at the expense of independence in other respects. In addition, long-range planning on the parts of some of the smaller users of iron ore has apparently involved arrangements [48] not only of considerable complexity but of a sort that, by establishing communities of interests, could lead to a lessening of competition.

As in the case of the nine major steel companies, the individual positions of the smaller users of iron ore in the period covered by the Commission's study varied considerably from one to another. An examination of the 10 smaller integrated steel companies [49] shows that 2 accounted for a substantial part of the western production of iron ore in 1948. These were Colorado Fuel & Iron Corp., the largest of the smaller integrated companies, and Kaiser Steel Corp. Though western ore is usually of lower quality than that in the Lake Superior region, Kaiser is apparently self-sufficient,[50] as is Colorado

[48] Some of these, which are not limited to iron ore, will be noticed below.

[49] The companies included in this group as of 1948 were the following:

	Capacity, net tons, as of Jan. 1, 1948		
	Blast furnace	Steelmaking	Percent blast furnace of steel capacity
Colorado Fuel & Iron Corp.	[a] 1,240,000	[b] 1,452,000	85.4
International Harvester Co.	719,710	900,000	80.0
Sharon Steel Corp.	709,620	1,572,000	45.1
Pittsburgh Steel Co.	554,000	1,072,000	51.7
Crucible Steel Co. of America	532,000	1,253,650	42.4
Ford Motor Co.	504,000	1,115,000	45.2
Alan Wood Steel Co.	454,800	550,000	82.7
Kaiser Steel Corp.	413,100	1,870,000	22.1
Portsmouth Steel Corp.	264,600	720,000	36.7
International Detrola Corp.[c]	144,000	413,100	34.8
Total	5,535,830	10,917,750	50.7

[a] 390,000 tons of this capacity were at Tonawanda, N. Y.
[b] 180,000 tons of this capacity were at the Tonawanda plant.
[c] Name changed to Newport Steel Co. in 1949.

Source: American Iron and Steel Institute, Iron and Steel Works Directory of the United States and Canada, 1948.

[50] Kaiser Steel Corp.'s annual report for the year ending June 30, 1951, recorded that "production at the Eagle Mountain Mine in Riverside County, California, totaled 1,094,990 net tons of iron ore averaging about 53 percent metallic content," as compared with 834,234 net tons produced during the preceding fiscal year. Eagle Mountain's reserves were characterized as "substantial"; and it was pointed out that "because of the economy of open pit mining and the short haul to the mill—164 railroad miles—the delivered iron ore cost at the Fontana plant remains among the lowest in the country" (op. cit., pp. 9–12).

Regarding ore production and ore reserves, Kaiser Steel's annual report for the year ending June 30, 1952, had this to say (p. 12):

"Iron ore output at the Company-owned mine at Eagle Mountain in Southern California totaled 1,496,545 net tons for the year. This will be stepped up to the rate of 2,250,000 tons per year when the third blast furnace is placed in operation in the Spring of 1953. * * * Additional reserves of ore were proved up with the completion of test drilling at the easterly end of the Eagle Mountain deposit. In addition, Kaiser Steel purchased the stock of the Iron Queen Mining Company, adjacent to the Eagle Mountain property, thereby increasing the reserves of the Company as well as providing better access to certain of its Eagle Mountain ore bodies."

Fuel & Iron, so far as its western operations are concerned.[51] None of the major ore merchants reported any contractual commitments with either company. Iron ore for Colorado Fuel & Iron's plant at Tonawanda, N. Y. (near Buffalo), which "has integrated steel making facilities and operates its own blast furnaces and open hearth furnaces," [52] was, during most of 1948, provided by Republic Steel.[53] "A blast furnace having a rated capacity of 180,000 net tons annually, which had not been operated since September, 1944, was rehabilitated and put in operation in August, 1948." [54] In March 1949, and again in June 1950, Colorado stated: "Currently the larger portion of the iron tonnage produced is sold on the market. The balance of the iron produced is used in the plant's open hearth furnaces." [55] During 1950 and 1951, ore for the blast furnaces came from the Great Lakes area.[56]

In March 1951, Colorado Fuel & Iron acquired all the outstanding capital stock of the semi-integrated Worth Steel Co., Claymont, Del., which became a wholly owned subsidiary under the name of Claymont Steel Corp.[57] By the end of 1951 "the larger portion of the iron tonnage produced" by the blast furnaces at Tonawanda was being "used in the open hearth furnaces at the Plant or shipped for use in the open hearth furnaces at the Claymont Plant. The balance of the iron produced" was being "sold on the market." The prospectus which gave this information also discussed at some length a proposal "to acquire a blast furnace and iron ore mine to insure and augment the supply of iron required to support increasing steel production at the Claymont Plant. The blast furnace and iron ore mine," it was said, "would be obtained by acquiring all the assets and property of The E. & G. Brooke Iron Company" at Birdsboro, Pa., a distance of only 67 miles by rail from Claymont.[58] Brooke, established in 1788, had had a long history as an independent producer of pig iron before control of the company was acquired in 1947 by two semi-integrated steel manufacturers (one of which was Worth Steel Co.) and a third user of pig iron. Under a 5-year contract, to which Worth had been a

[51] A Colorado Fuel & Iron Corp. prospectus dated December 6, 1951, reported that iron ore is supplied to the Pueblo plant, "the principal plant of the Corporation's western operations," from the company's own mines, describing as "extensive" its "iron ore properties near Sunrise, Wyoming, and in Iron County, Utah." The same prospectus stated: "Based on the rate of use prevailing at the Pueblo Plant in 1950, and also taking into account the added requirements of the presently proposed expansion program, it is estimated that the Corporation has available proven reserves of * * * iron ore * * * sufficient to supply said Plant for a period of twenty years or more. * * * The Corporation is presently engaged in efforts further to increase iron ore * * * reserves. * * * The Pueblo Plant purchased approximately 392,000 net tons of scrap during 1950, based on an open hearth charge of approximately 50% scrap and 50% pig iron. Annual purchases when said plant is operating at capacity range between 250,000 and 350,000 net tons, depending upon variations in the pig iron charge. These scrap requirements are usually available at comparatively favorable prices because of the Plant's location at the center of an area in which no other steel plants are located" (op. cit., pp. 7-8, 17).

[52] Colorado Fuel & Iron Corp. prospectus of December 6, 1951, p. 9.

[53] Cf. Colorado Fuel & Iron Corp., prospectus of March 29, 1949, p. 12: "From September 25, 1939 to September 30, 1948 the supply of iron ore for blast furnace use of the Buffalo plant and the sale of pig iron produced therefrom was governed by agreements with Republic Steel Corporation. Under these agreements Republic Steel Corporation provided necessary raw materials, the Corporation provided plant facilities and labor, and costs of production were divided; the Corporation obtained its requirements of pig iron for use in its open hearth furnaces, and the remainder thereof was sold and the net profits from such sales were apportioned equally between the two companies. In 1948, the Corporation determined to manufacture and sell pig iron at its Buffalo blast furnaces for its own account, and accordingly the existing contract with Republic Steel Corporation was terminated. The Corporation now has on hand a sufficient supply of iron ore to permit it to operate its blast furnaces at the Buffalo plant until June 1, 1949, and it anticipates making satisfactory arrangements for procuring iron ore to cover its requirements for the ensuing year."

[54] Colorado Fuel & Iron Corp., prospectus of December 6, 1951, p. 13.

[55] Colorado Fuel & Iron Corp., prospectus of March 29, 1949, p. 8, and prospectus of June 2, 1950, p. 8.

[56] Cf. Colorado Fuel & Iron Corp., prospectus of June 2, 1950, p. 7, and prospectus of December 6, 1951, p. 9, according to both of which "Mesabi and other Great Lakes iron ores are purchased for the Buffalo Plant from outside sources and transported to the Buffalo Plant by water."

[57] Dissolved June 30, 1952, following transfer of all its assets to Colorado Fuel & Iron, which assumed all Claymont's liabilities.

[58] Colorado Fuel & Iron Corp., prospectus of December 6, 1951, pp. 9, 14.

party and which extended to November 1952, Claymont was receiving approximately 32 percent of the pig iron produced by Brooke.[59]

Brooke was acquired by Colorado Fuel & Iron in January 1952, and is now being operated as E. & G. Brooke Iron Division.

Alan Wood Steel Co., Conshohocken, Pa., though an integrated steel manufacturer, has long been a seller of pig iron. Both in 1948 and 1949 the company was selling "foundry pig iron to foundries on the Middle Atlantic seaboard and in New England" and "basic pig iron * * * to nearby nonintegrated steel companies," its sales amounting to approximately half its pig-iron production. The remainder was used in its own open hearth furnaces.[60]

Alan Wood owns two iron mines in New Jersey, one near Oxford and one near Dover.[61] From 1945 until the latter part of 1949, the Oxford mine was not in operation; but in 1944 the company's mines had supplied 62 percent of its ore requirements. In 1948 the company obtained from its own mining properties 40 percent "by iron content, of all ores used * * * in the blast furnaces," and its further requirements by purchase. "Substantially all of the iron ore purchased from outside sources (most of which is Great Lakes ore)," so it was stated in 1948, "has been for many years and is currently being obtained from two suppliers under one-year contracts. Recently the Company entered into an additional one-year contract with a third supplier. The Company has recently entered into a three-year contract with one of these suppliers covering a relatively small proportion of its ore requirements." [62] Subsequently, it appears, the number of outside suppliers was reduced to two.[63]

During the period when the Oxford mine was not producing, development work was being carried on, and early in 1951 Alan Wood described as follows its position with respect to ore reserves:

> * * * The Company estimates that the maximum capacity [of its two mines] for mining and concentrating is about 40,000 net tons of concentrates per month from both mines. Current output is approximately 60% of this capacity, which constitutes approximately one-half of the Company's iron ore requirements. On the basis of the Company's present iron ore requirements and at the present rate of withdrawal, it is estimated that the remaining recoverable ore reserves in these mines are sufficient to continue supplying similar proportions of the Company's requirements for at least twelve years.[64]

As for the more remote future, Alan Wood is hopeful of being able to obtain foreign ores, some of which it has used in the past.[65]

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[59] Ibid., p. 14.

[60] Alan Wood Steel Co., Form 1-MD Annual Report pursuant to sec. 15 (a) of Securities Exchange Act of 1934, for fiscal year ended December 31, 1948, exhibit A, and Form 10-K Annual Report pursuant to sec. 13 or sec. 15 (d) of Securities Exchange Act of 1934, for fiscal year ended December 31, 1949, exhibit A.

[61] The crude ore is concentrated with milling equipment at the mines, and is shipped by rail to the blast furnaces at Swedeland, Pa.

[62] Form 1-MD Annual Report to SEC for 1948, exhibit A.

[63] Form 10-K Annual Report to SEC for 1949, exhibit A. Cf. Form 1-MD Annual Report to SEC for 1948, exhibit A, where the company mentions, as one of the advantages of its geographical location, "proximity * * * to a normally adequate supply of scrap."

[64] Form 10-K Annual Report to SEC for 1951, exhibit A.

[65] Cf. Form 10-K Annual Report to SEC for 1949, exhibit A: "The Company's location close to the eastern seaboard has in the past made available, on a relatively favorable basis, the use of foreign ores. Such ores were not available during the war and at the present time are not available on a favorable price basis. However, the Company expects that ultimately it will be in a position to obtain sufficient foreign ores to meet its requirements on a more favorable basis than at the present time. In addition, as the known Great Lakes ore reserves become further depleted and require further beneficiation, the Company believes that its location close to the eastern seaboard and the availability of foreign ores will be favorable competitive factors."

In its annual report for 1951 Alan Wood informed its stockholders that "a new open hearth of modern design costing $500,000 was placed in operation in May 1951, increasing our annual open hearth rated capacity by 75,000 tons, and contributing substantially to the record high ingot production," and that at its Scrub Oaks mine (near Dover) it was preparing "to mine iron ore from lower levels." It does not appear, however, that increased ingot capacity will result in Alan Wood's discontinuing the sale of pig iron, since it has recently been stated that blast furnace "capacity is more than adequate for the Company's steel producing needs" (Form 10-K Annual Report to SEC for 1951, exhibit A).

Two of the smaller integrated companies have interests in iron mines in the Lake Superior region. Crucible Steel Co. of America owns 50 percent of the stock of Snyder Mining Co., which holds in fee or by lease several mining properties in Minnesota, most of them on the Mesabi Range.[66] The other stockholder is Shenango Furnace Co., which holds the remaining 50 percent interest. Total shipments of ore by Snyder in 1948 amounted to slightly more than 1 million tons, of which Crucible's share was approximately 500,000 tons, or about half of the iron-ore requirements of the company if its blast furnaces operated at full capacity. No long-term contracts were reported by any of the ore merchants with Crucible Steel. Its situation with respect to ore in 1948 was no novelty for Crucible, yet up to 1948 it had manifested relatively little apprehension concerning the future availability of ore, apparently satisfied that its half interest in Snyder Mining Co. afforded reasonably adequate security.[67]

Toward the end of 1946, a year in which Crucible's blast furnace capacity was the same as in 1948,[68] and Snyder's shipments of ore were about 137,000 tons less than in 1948,[69] Crucible stated:

> The Company purchases most of its iron ore requirements under contract from the Snyder Mining Co. * * * Practically all of the coal, coke, and pig iron necessary for normal operations [70] are produced by the Company.

Regarding future supplies of ore from Snyder it was said:

> The Company estimates that its portion of the ore reserves, including merchantable ores and small amounts of marginal and low-grade ores is sufficient to supply the blast furnace requirements of the Company for more than fifteen years on the basis of the average annual consumption of such ore for the past ten years, and is sufficient for at least ten years on the basis of the maximum annual tonnage of ore which the Company is entitled to receive under the agreement.[71]

In a proxy statement dated March 15, 1950, Crucible told its stockholders that the company "purchases substantially all of its iron ore requirements" under its contract with Snyder Mining Co., which was referred to in Crucible's Annual Report for 1950 as "a 50 percent owned affiliate of the Company and supplier of iron ore for the Company's blast furnaces." The same report did, however, announce that "additional iron ore was obtained through a term contract which will

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[66] In 1948 these included operating mines, inactive mines with available tonnages approaching a total of 5 million tons, and an undeveloped reserve property. The Martin mine (inactive), the lease of which was evidently acquired in 1948, was on the Cuyuna Range; all the other properties were on the Mesabi Range (Mining Directory of Minnesota, 1948, 1949). Cf. Crucible Steel Co., Annual Report for 1948, p. 6: "The Company's ore mining affiliate continues its active search for additional iron ore and leased one property during the year which added somewhat to its reserve."

[67] Cf., however, Crucible Steel Co. of America, Annual Report for 1949, p. 5: "The Snyder Mining Company is continuing its search to add additional ore to its present reserves."

[68] American Iron and Steel Institute, Iron and Steel Works Directory of the United States and Canada, 1945 and 1948.

[69] Mining Directory of Minnesota, 1949.

[70] For years past, however, "normal operations" for Crucible have involved the use of substantial quantities of scrap. Cf. Crucible Steel Co. of America, prospectus of November 12, 1946: "The alloys and other more important materials used directly by the Company are purchased either in the open market or under requirement contracts, which normally extend for one year. Other than in the case of steel scrap, in which there has been an industry-wide shortage for some time, all of the principal raw materials are currently available in reasonably adequate quantities. The shortage of steel scrap has not thus far reduced the Company's output of steel, but has caused it to use proportionately more pig iron and ferro-alloys than would be used if scrap were in adequate supply."

As of January 1, 1948, Crucible had 532,000 net tons capacity in blast furnaces to serve 1.2 million tons capacity in steel-making furnaces. This gives a ratio of pig iron to steel capacity of about 42 percent, compared with an average for the nine leading companies of 77.6 percent in 1949, and of the industry as a whole of 73.4 percent. This indicates that Crucible must depend heavily on purchased scrap for its metallics requirements.

Cf. Crucible's Annual Report for 1951, p. 7: "The year was one of steady operations, with few interruptions, * * * All plants and major departments turned in good production records. In some cases output was limited by shortages of such raw materials as alloys and scrap, * * *"

[71] Prospectus of November 12, 1946, pp. 9, 14–15. The same prospectus also stated that "from time to time the Company purchases pig iron and iron ore from The Shenango Furnace Company and ingot molds from Shenango-Penn Mold Company" (p. 9).

strengthen the Company's ore position for the future." [72] The annual report for 1951 discussed in some detail the year's accomplishments in carrying out the company's program for expanding its production facilities. Regarding the part of the program concerned with providing "increased open hearth and electric furnace capacity," the stockholders were informed that its completion "will bring the annual melting capacity at Midland Works to 1,300,000 tons; 300,000 tons in electric furnace capacity and 1,000,000 tons in open hearth furnace capacity," and that "the open hearths will have back of them iron making capacity sufficient for a 70 per cent hot iron charge." It was stated further that the foundations were "in place for the new blast furnace and erection of steelwork" had begun, that "the rated capacity of this furnace is 1,000 tons of pig iron per day," and that it was "scheduled to begin production in the third quarter of 1952." At the same time, it was reported:

> In the early part of the year, Snyder Mining Company, Crucible's supplier of iron ore, having completed arrangements to operate its Whiteside Mine on the Mesabi Range in Minnesota jointly with an adjacent property, contracted for the stripping of the two properties. Mining equipment * * * was ordered, and by the close of the year a large amount of the overburden had been removed from the ore body, and much of the equipment was delivered. It is expected the Whiteside operation will begin production in the Summer of 1952. When completed it will be capable of producing very large annual tonnages and will more than replace other iron ore mines which are nearing exhaustion.[73]

Continued dependence upon Snyder as its primary source of ore seems to be indicated in Crucible's proxy statement of March 12, 1952, which, after referring to its contract with Snyder, said:

> The Company purchases the major portion of its iron ore requirements under this contract.

About the "term contract," entered into in 1950, under which "additional iron ore was obtained," no more is known than was stated in the sentence quoted in an earlier paragraph. Thus it is impossible to estimate the extent to which deliveries under it may have supplemented, or will supplement, supplies provided by Snyder, though there seems to be no reason to suppose that the ore supplied under the contract in question has constituted or will constitute other than a minor portion of Crucible's ore requirements. Nothing has been learned concerning any other recent ore contracts made by Crucible.

Confidence on Crucible's part concerning the future availability of ore is indicated, at least ostensibly, by its having contracted in 1951 to supply pig iron to others. But if Crucible's expanded operations are to be sustained on the projected scale, with reliance continuing to be placed upon Snyder as its major source of ore, it appears that Crucible will somehow have to obtain more than its proportionate share of a considerably augmented production by Snyder. Such an arrangement on any long-term basis, without change in the division of ownership of Snyder, would probably require modification of the contract between Crucible, Shenango Furnace, and Snyder in one or more respects. From year to year, however, it might be possible for Crucible's needs to be met in accordance with the terms of the contract—provided that

[72] Op. cit., p. 6. Cf. Mining Directory of Minnesota, 1951, where the Sellers Triangle mine is first separately listed. This mine, on the Mesabi Range, was operated by Oliver as part of the Sellers mine prior to 1951, when it was apparently leased by the fee owners to Snyder Mining Co., by which it is now being operated. Tonnage available May 1951 was 467,313 tons; 19,657 tons of ore were shipped in 1951 (Mining Directory of Minnesota, 1952).

[73] Crucible Steel Co. of America, Annual Report for 1951, pp. 5, 9–11.

Shenango were willing to accommodate its partner,[74] as there is reason to infer that it has been in the past.[75]

Besides having been equal partners in Snyder Mining Co. for more than 20 years, Crucible and Shenango have otherwise been closely allied for a considerable period,[76] and have collaborated in long-range planning.[77] In fact, with respect both to large and to relatively small

[74] Snyder Mining Co., "formed * * * for the purpose of taking over the ownership and operation of the extensive mining properties of the Shenango Furnace Co. on the Mesabi Range" (Moody's Manual (Industrials), 1930, p. 537), has been jointly owned by Crucible and Shenango since 1930. An agreement dated March 5, 1930, between Snyder, Shenango, and Crucible, contains provisions summarized by Crucible as follows:

"The agreement provides that the total tonnage of iron ore to be mined and shipped each year shall be between 600,000 and 1,200,000 tons, unless the owners of a majority of the Mining Company's stock change such limits for any year.

"Each year, on or before March 1, the Stockholders are to notify the Mining Company of their respective total requirements of ore during the ore season or year immediately following such notice and thereupon are to agree on the total tonnage of ore, within the said limits, to be mined and shipped in that year. If they fail to agree, such tonnage shall be twice the larger amount required if two Stockholders each own 50% of the Mining Company's stock * * *.

"The Mining Company agrees to sell and the Stockholders agree to buy, in proportion to their respective stock holdings, the total tonnage of ore of all grades mined and shipped each year. Subject to the minimum tonnage provision above, any Stockholder may, within ten days of receipt of notice from the Mining Company of the amount to be mined and shipped, reject all or any part of its proportion of such amount. Any amount so rejected shall be offered to the other Stockholder and if accepted added to the latter's quota for that year. To the extent that such amount is not accepted by any Stockholder, such amount shall, subject to the minimum tonnage provision above, be deducted from the total tonnage of ore to be mined and shipped that year.

* * * * * * * *

"* * * Any stockholder may dispose of all or any part of its quota of ore.

* * * * * * * *

"The agreement shall continue so long as iron ore shall be mined and shipped from the properties of the Mining Company. It may be altered or amended with the consent of the owners of a majority of the Mining Company's stock." (Crucible Steel Co. of America, prospectus of December 30, 1940, pp. 22–23. A copy of the agreement summarized in the prospectus was filed as exhibit I–1 to the Registration Statement.)

Crucible's prospectus of November 12, 1946, in which the terms of the agreement with Snyder Mining were outlined, stated (p. 14): "Under an agreement between Snyder Mining Company and its stockholders, all the ore produced each year is to be sold to the stockholders in proportion to stock ownership at cost of production as computed in accordance with the agreement. * * * Nothing in the agreement prohibits any stockholder from selling or otherwise disposing of its quota of ore or any part thereof." There is no evidence that the maximum tonnage specified in the original contract has been exceeded except in individual years, or that the upper limit of 1,200,000 tons has ever been greatly increased. In only 6 of the 15 years, 1937–51, did tonnage shipped exceed the maximum to be mined and shipped—in 1 year by 218,643 tons, in no other year by as much as 100,000 tons, and in 3 years by less than 20,000 tons (Mining Directory of Minnesota, 1938–52).

Without changing the contract, the partners in Snyder could, after appropriate consultation and prearrangement, decide in any year to mine and ship a total tonnage of ore exceeding the contract maximum by an agreed amount. Crucible could then give notice requisitioning such tonnage as, when supplemented by what Shenango could be counted upon to reject or to accept and sell to Crucible, would result in the largest possible part of its requirements being supplied by Snyder ore.

[75] With respect, i. e., to sale of ore. Purchases of ore from Shenango Furnace were reported by Crucible in 1946 (cf. note 71, above); and Crucible's proxy statements of March 16, 1951, and March 12, 1952, both said that the company "in the ordinary course of its business purchases iron ore" from Shenango Furnace.

[76] William P. Snyder, Jr., is chairman of Crucible's board of directors and of its executive committee; president and a director of Shenango Furnace Co. and chairman of Shenango-Penn Mold Co., wholly owned subsidiary of Shenango Furnace; and president of Snyder Mining Co. He has been a director of Crucible since 1930, the year in which the contract between Crucible, Shenango Furnace, and Snyder Mining was made, being at that time president of the other two companies. He has been a member of the executive committee of Crucible continuously since 1938, its chairman since 1942, except for part of 1945, and chairman of the board of directors since September 1944.

In its Form 10–K Report to the Securities and Exchange Commission for 1948, Crucible stated: "The registrant has been informed by Mr. W. P. Snyder, Jr., chairman of the board of the registrant, that he is president and a director of The Shenango Furnace Company and that The Shenango Furnace Company has 41,063 shares of capital stock outstanding, of which Mr. Snyder owns 9,587 shares directly and indirectly, and that he is one of three trustees of, and is entitled during his life to one-half the income from, a trust which owns 14,467 shares of such stock."

[77] One of the most conspicuous instances of such collaboration is to be found in the organization of Midland Coke Co., an account of which was given in Crucible's Annual Report for 1947 (pp. 5–6), from, which the following excerpts are taken:

"During the Spring and Summer of 1947 it became evident that, by reason of the shortage of industrial fuel, the operations of the Midland Works might be seriously hampered in subsequent winters. Furthermore, while the existing by-product coke ovens at this plant are sufficient to provide Crucible's current needs for coke, most of these ovens have an estimated remaining life of only 10 years. Midland Coke Company was organized in order to provide additional gas now needed and at the same time to make available, in part at least, a coke supply when the old ovens are worn out. This new company then contracted with Koppers Company, Inc., for the construction of 63 new by-product coke ovens and related facilities, and for the enlargement and modernization of Crucible's existing by-product recovery facilities. As part of the over-all transaction,

"1. Crucible agreed to operate the new ovens for the account of Midland Coke and to sell to Midland Coke the coal needed for the new ovens. Midland Coke agreed to sell to Crucible all surplus gas produced;

"2. The Shenango Furnace Company agreed to purchase all the by-product coke produced by the new ovens for 10 years; and

"3. Koppers agreed to purchase all the tar and benzol produced for 10 years, and to act as agent for Midland Coke in the sale of all other by-products produced.

"It is estimated that the aggregate cost of Midland Coke's construction program will be $6,200,000, which will be financed chiefly through loans to Midland Coke of $3,100,000 from Mellon National Bank and Trust

matters, their relationship has been notably one of mutual assistance,[78] though Shenango, by reason largely of its more adequate ore supply, appears to enjoy greater flexibility of operation.[79] Shenango, though not integrated with steel-making facilities, has had since 1927 a subsidiary which manufactures ingot molds and stools. This subsidiary, Shenango-Penn Mold Co., had in 1948 a capacity of 425,000 tons of iron ingot molds and stools, while the blast furnace capacity of its parent was 417,300 net tons of pig iron. Shenango's ability to function to any considerable extent as a merchant furnace and at the same time utilize Shenango-Penn's capacity for producing ingot molds was

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Company, and of $2,000,000 from The Shenango Furnace Company, to be evidenced by notes of Midland Coke Company maturing in annual installments commencing one year after the new ovens are completed (the Bank's notes maturing first). Substantially all of the construction fee of Koppers is to be paid in four installments commencing seven years after the ovens are completed.

"* * * Crucible has no direct obligation to pay said indebtedness, but, in case there should be a deficiency in Midland's funds, Crucible has agreed to advance to Midland Coke the funds necessary to meet any such deficiency.

"* * * Midland Coke's present paid-in capital is $500,000. Crucible owns 95% of the capital stock and has an option to purchase the other 5% (presently owned by Shenango)."

(At the time of the transaction outlined above, William P. Snyder, Jr., was a director of Mellon National Bank and Trust Co., and L. N. Murray, president and a director of Mellon and a director of Koppers, was a director of Crucible. These interlocking relationships are still in effect.) Further details regarding the organization of Midland are available in exhibits A–F to the amendment of November 1947 to Crucible's Form 8–K Report to SEC dated October 2, 1947. In exhibit F, Crucible and Shenango are said to "have caused Midland to be incorporated," and Shenango's motivation is indicated as having been "to secure an additional supply of coke." The coke from the new coke ovens was to be sold by Midland to Shenango at certain discounts from current market prices (exhibit D).

In this connection it may be noted that Shenango Furnace once owned coal lands and operated beehive coke ovens, though for some years it seems not to have been a producer of coke. In 1920 it was reported to own coal lands with an annual capacity of 400,000 tons of coal, and 200 beehive coke ovens with an annual capacity of 120,000 tons of coke. By 1926 the number of its coke ovens had been reduced by one-half, while the capacity of its remaining ovens was 90,000 tons of coke. The Iron and Steel Works Directory of the United States and Canada, 1938, showed the same number of coke ovens, with the same capacity, and indicated ownership of coal mines. The next (1945) edition of the Directory showed no coal mines among Shenango's raw material properties, and listed no coke ovens. Subsequent editions show no coke-producing facilities for Shenango (American Iron and Steel Institute, Iron and Steel Works Directory of the United States and Canada, 1920, 1926, 1938, 1945, 1948, 1951).

During 1948 "it developed that it would cost approximately $1,000,000 more to complete" Midland's new coke ovens than had originally been estimated. "The financing of $800,000 of this additional cost," said Crucible's Annual Report for 1948 (p. 6), "has been arranged through additional loans to Midland Coke Company of $500,000 from Mellon National Bank and Trust Company, $100,000 from The Shenango Furnace Company, $100,000 from Koppers Company, Inc., and $100,000 from the Company. * * * To make up the remaining additional cost, Midland Coke issued and sold to Shenango at par 2,000 shares of 4% Cumulative Preferred Stock of a par value of $100 per share with full voting rights. The Company purchased the 100 shares of Common Stock of Midland owned by Shenango at Shenango's cost of $25,000, and the Company now owns all of the outstanding Common Stock."

[78] Shenango owns three ore vessels operating on the Great Lakes and, under contracts, has for years transported part of Crucible's iron ore. In 1950 and 1951 Crucible paid to Shenango $319,768 and $454,708, respectively, for transportation of ore (Crucible Steel Co. of America, prospectus of November 12, 1946, and proxy statements dated March 16, 1951, and March 12, 1952). Ingot molds are purchased by Crucible from Shenango-Penn Mold Co., Shenango Furnace's subsidiary.

Crucible's proxy statement dated March 12, 1952, reported: "The [Midland] Coke Company has agreed to sell Shenango all the by-product coke produced by the Coke Company's coke ovens for 7 more years. The Coke Company has also agreed to sell Shenango not more than 3,000 tons nor less than 1,000 tons of pig iron per calendar month, and the Company has agreed to supply such iron to the Coke Company; such contract runs for a term of one year after the Company completes the installation of its blast furnace at the Midland Works * * * The Company has assumed liability to Shenango for any damage resulting to Shenango by reason of any failure by the Company to comply with its obligation to supply such iron to the Coke Company."

It seems probable that the sale of pig iron to Shenango was covered by one of the contracts mentioned in the following passage from Crucible's Annual Report for 1951 (p. 14):

"During 1951, Crucible joined with the Coke Company in contracts with two steel companies and The Shenango Furnace Company for the sale of pig iron by Crucible to the Coke Company in exchange for coke and coke oven gas, and by the Coke Company to the other companies. A part of these agreements provides for loans by the steel companies to the Coke Company, the proceeds of which were used to retire an equivalent amount of long-term debt. The new loans will mature in 1959 and will be repaid in part through sales of pig iron to the lenders."

The significance of the contracts in question, concerning which no more is known than is stated in the quoted paragraph, is not altogether clear. It does seem apparent, however, that there has been established a community of interest among Crucible and two other steel companies, and that Crucible has reason to feel assured of its ore supply for several years to come.

[79] Under a contract dated April 15, 1929, and expiring with the 1936 ore season, Shenango agreed to sell and Pittsburgh Coke & Iron agreed to purchase 22½ percent of the iron ore requirements of the blast furnaces operated by Pittsburgh Coke (Listing Statements of the New York Stock Exchange, A–10950, Pittsburgh Coke & Iron Co., dated June 15, 1937). In 1930, when Crucible and Shenango became partners in Snyder Mining Co., Shenango was operating two blast furnaces, the annual capacity of which was 410,000 tons of pig iron. Fifteen years later, the annual capacity of its two furnaces was 417,300 tons, which was still Shenango's capacity in 1951. Since this was less than the capacity it had in 1929, it is evident that Shenango has not been ambitious to increase its production of pig iron, though between 1945 and 1948 it increased by 23,000 tons the productive capacity of Shenango-Penn Mold (Iron and Steel Works Directory of the United States and Canada, 1920, 1930, 1945, 1948, 1951), and has lately assisted Pittsburgh Coke in financing the cost of additional facilities for pig-iron production.

in 1948, had been for some years earlier, and apparently is now, a matter of pig-iron supply, not of the availability of iron ore. Since 1939, when Shenango-Penn acquired its Neville Island (Pennsylvania) plant, Shenango Furnace, under a series of contracts, has been selling iron ore to Pittsburgh Coke & Chemical Co. and purchasing from that company pig iron for the production of ingot molds. The earliest of these contracts was, in effect, an arrangement for Shenango Furnace to sell 1.8 tons of ore for each ton of pig iron to be purchased;[80] but successive contracts have provided for the sale by Shenango of progressively smaller tonnages of ore in proportion to the volume of pig iron to be delivered by Pittsburgh Coke.[81] The latest agreement (dated July 16, 1951), which involved the purchase by Shenango-Penn of 10,000 shares of $5 preferred stock of Pittsburgh Coke at a price of $100 per share—

provides for the sale by [Pittsburgh Coke] to Shenango-Penn of its pig iron requirements for a five year period but, until such time as the new blast furnace [of Pittsburgh Coke] is completed,[82] not in excess of 7,500 gross tons per month, and, after the completion of the new blast furnace, not in excess of 16,000 gross tons per month; such iron is, as soon as feasible, to be delivered in molten form and the price thereof is to be the market price for pig iron except that where cold pig iron is delivered the price is to be reduced by 50 cents per gross ton. The contract also provides that Shenango will sell at the market price up to 150,000 gross tons of iron ore to [Pittsburgh Coke] annually, in the years 1952 to 1956, inclusive.[83]

The agreement just summarized, it is important to note, was entered into subsequent to the negotiation of a new contract (dated April 1, 1951) with Hanna Coal & Ore Corp. providing—

for the major requirements of [Pittsburgh Coke's] present Neville Island blast furnace and the new blast furnace,

during a 15-year period expiring in 1969.

The ore supplied under this contract is to be either Lake Superior or Labrador ore, and the first deliveries thereunder are to be made in 1955.[84]

As decreasing tonnages of pig iron of Shenango's own production have been needed to support the ingot mold business of its subsidiary,

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[80] In August 1938, Pittsburgh Coke & Iron Co. (former name of Pittsburgh Coke & Chemical Co.) "purchased approximately 47% of the common stock of Hunter Steel Company. Upon such acquisition," said Pittsburgh Coke's Annual Report for 1939, "Hunter Steel Company commenced work on the construction of an ingot mould plant. In 1939, when this ingot mould plant was nearing completion, Hunter Steel Company sold its entire plant and a substantial portion of the machinery and equipment * * * to The Shenango Furnace Company * * * Hunter was able to sell its plant on advantageous terms only by reason of the fact that it agreed to purchase iron ore from The Shenango Furnace Company in an amount equal to the purchase price. Hunter could not have taken this iron ore, as it does not use ore in its operations, but for the fact that your Company agreed to purchase the iron ore from Hunter at its cost. The purchaser (The Shenango Furnace Company) in turn has agreed to buy pig iron for use in the ingot mould plant in ratio to the iron ore taken, and in this way your Company liquidates the iron ore purchased by it from Hunter and acquires another customer for its pig iron." (Control of Hunter Steel had been acquired by Pittsburgh Coke & Iron in April 1939.) Under the original contract, Shenango was to receive for 10 years an annual minimum tonnage of 21,000 tons of pig iron, and Hunter was obligated for the same period to purchase each year the tonnage of iron ore needed for the production of Shenango's pig-iron requirements, as limited by the contract. The contract mentioned 84,000 tons of pig iron as the maximum annual quantity that could be purchased by Shenango, but also limited to 22½ percent of the iron ore requirements of its Neville Island blast furnace the tonnage of iron ore to be converted by Pittsgurgh Coke into pig iron to be sold by Hunter to Shenango. In connection with the liquidation of Hunter Steel Co., as of December 28, 1940, and the assumption of its obligations by Pittsburgh Coke (which held all but a small minority interest in Hunter), the maximum limitation upon the obligation of Pittsburgh Coke to purchase iron ore from Shenango was increased (Listing Statements of the New York Stock Exchange, A–11293, Pittsburgh Coke & Iron Co., dated November 4, 1939, exhibit A; Pittsburgh Coke & Iron Co.: Form 10–K Report to SEC for 1939, Form 8–K Reports to SEC, dated September 8, 1939, and February 14, 1941).

[81] The 1939 agreement was canceled as of January 1, 1949, and as of the same date a new agreement was entered into, pursuant to which, during the 3 years 1949–51, Pittsburgh Coke agreed to sell to Shenango up to 7,500 gross tons of pig iron per month and Shenango agreed to sell to Pittsburgh Coke a maximum of 125,000 gross tons of ore per year (Pittsburgh Coke & Chemical Co., Form S–1 Registration Statement under The Securities Act of 1933, dated July 3, 1951, exhibit 15–n).

[82] The new furnace was expected to be in operation on or before July 1, 1952.

[83] Pittsburgh Coke & Chemical Co., prospectus of April 18, 1952, and amendment No. 1, dated July 18, 1951 (exhibit 15–x), to Form S–1 Registration Statement under The Securities Act of 1933, dated July 3, 1951.

[84] Pittsburgh Coke & Chemical Co., prospectus of July 23, 1951 (p. 12), and Form S–1 Registration Statement under The Securities Act of 1933, dated July 3, 1951, exhibit 15–l.

Shenango should, it would seem, have found it possible to supply its blast furnaces, fulfill its obligations to Pittsburgh Coke, and still have ore for sale to others—especially since its interests in ore properties are not confined to Snyder Mining, and in view of its having had for some years a contract with Oliver. But what Shenango can do for Crucible in the way of making ore available is to a considerable extent, and perhaps most immediately, made possible by Shenango's arrangements with Pittsburgh Coke, and less directly by Shenango's having been able to obtain ore from Oliver and Pittsburgh Coke's relationship with Hanna, upon which it seems to have become increasingly dependent. If Crucible's alliance with Shenango has not inspired Crucible with an interest in Pittsburgh Coke, there is another bond: Great Lakes Steamship Co., which for many years has transported most of Crucible's ore and the president of which has been a director of Crucible since 1928, came under the control of Pittsburgh Coke in July 1952. Pittsburgh Coke and Pittsburgh Steel, besides having contractual relationships and four common directors, are closely associated with J. H. Hillman, Jr., and corporations directly or indirectly controlled by him and members of his family.

Pittsburgh Steel Co. is also an owner of iron-ore properties in the Lake Superior region. It has a 16-percent interest in the Mesaba-Cliffs Mining Co., managed by Cleveland-Cliffs. It has stock investments in two companies managed by Pickands Mather, a 22½-percent interest in Bennett Mining Co., and a 10-percent interest in Plymouth Mining Co.[85] These interests are of long standing; and Pittsburgh's share of what it calls "partnership" ore from these companies generally made up more than half the tonnage used in its blast furnaces through 1947.[86] In that year, "partnership" ore and exchanges of such ore constituted 58 percent of the blast furnace ore purchased by Pittsburgh. The remainder, however, had to be obtained in the open market, since Pittsburgh had no term contracts covering the 1947 ore season.[87]

When, in December 1947, Pittsburgh acquired from the War Assets Administration an uncompleted blast furnace adjacent to the blast furnaces at its Monessen plant, the company apparently took stock of its ore resources and began to realize with unpleasant acuteness the insecurity of its position.[88] The following passage from Pittsburgh Steel's prospectus of April 7, 1948, while it deals with Pittsburgh's particular problems, at the same time well illustrates the plight with respect to ore supplies of the smaller integrated steel producer who aspires to become larger:

[85] Reports to FTC; various prospectuses of Pittsburgh Steel Co., e. g., those of December 17, 1940, and July 16, 1951.

[86] "Approximately 71% of the ore purchased by the Company from 1943 to 1946, inclusive (including ore given in exchange by the Company * * *), was acquired from" Mesaba-Cliffs, Bennett, and Plymouth (Pittsburgh Steel Co., prospectus of April 7, 1948). "Approximately 78% of the 730,500 tons of ore purchased by the Company for delivery during the 1941 season of lake navigation (including ore given in exchange * * *) was acquired from" the same mining corporations (idem, prospectus of January 14, 1942).

[87] Pittsburgh Steel Co., prospectus of July 16, 1951.

[88] This is not to say that Pittsburgh had done nothing in recent years toward increasing its ore reserves. In 1948 it was stated: "The Company also owns 50% of the capital stock of the Orote Iron Company, the other 50% being owned by Pittsburgh Coke & Chemical Company * * * The property of this corporation, which is held under mining leases, is situated in the Mesaba Range in Minnesota and has not as yet been developed. The Company's proportionate interest, through its stock ownership, in this iron-ore property is estimated at 1,400,000 gross tons. The Company and Pittsburgh Coke & Chemical Company also have equal ownership in a corporation that has been organized to acquire leases on certain ore lands in Wisconsin. The operations of such corporation have not progressed beyond exploratory stages at this time" (Pittsburgh Steel Co., prospectus of April 7, 1948).

Orote Iron Co. was first listed in the Mining Directory of Minnesota in 1946, when the available tonnage of its reserve property in May 1945, was given as 1,659,132 tons. Available tonnage was the same in May 1951, and no shipments had been made up to that date (Mining Directory of Minnesota, 1952).

* * * Operation of the new blast furnace being acquired by the Company * * * will increase the Company's requirements at full capacity of blast furnace iron ore by approximately 680,000 gross tons per year. The Company has not experienced undue difficulty in making at generally satisfactory prices the open market purchases of iron ore required for the two blast furnaces now being operated, but the Company has not yet been able to make sufficient commitments for iron ore to provide for the operation of both of such furnaces together with the new blast furnace throughout the ore season ending on May 1, 1949. It is contemplated that the new blast furnace will be ready for operation in May 1948. Present commitments for iron ore will permit the operation of the new blast furnace and one of the present furnaces during such ore season. It is anticipated that in the future the Company will have to rely, as will most other steel companies in varying degrees, upon ores obtained from new sources or from the beneficiation of lower grades of ore which may in either case result in increased costs. The ore reserves of certain large competitors of the Company are believed to be of sufficient extent to warrant the expectation that such competitors will be able to produce therefrom under favorable cost conditions at a time when the Company may find it necessary to rely upon ores obtained from new sources or from the beneficiation of lower grades of ore.

Discussing in its annual report for 1948 its "long range program of improving its plants to gain maximum efficiency and consequently lower costs," Pittsburgh remarked concerning its ore situation:

The Company has to face in the future, as opportunities are developed, large investments in the purchase of iron ore reserves, in which the Company needs additional protection.[89]

By 1950 Pittsburgh had apparently reached the conclusion that rather soon it would be "necessary to rely upon ores obtained from new sources," to the extent at least of a considerable portion of its requirements.

Upon completion of the Company's program of capital improvement,

said Pittsburgh Steel in 1951,

the Company's annual consumption of iron ore at capacity operations will increase gradually to approximately 1,600,000 tons in 1953. For the years 1952 through 1965, the Company's "partnership" and long term arrangements are estimated to provide substantially all the Company's iron ore requirements at full capacity and open market purchases will be minor.

Regarding "partnership" ore, it was stated that "the Company's proportionate interest in the assured iron ore reserves" of Bennett, Mesaba-Cliffs, and Plymouth was "estimated to be in excess of 3,000,000 gross tons of merchantable ore;" that its "proportionate interest in the estimated iron ore reserves" of Orote Iron Co. was "approximately 1,400,000 gross tons;" and that "the Company has interests in 'partnership' ore operations of an exploratory nature, * * *

[89] Op. cit., p. 3. Cf. Listing Statements of the New York Stock Exchange, A-13619. Pittsburgh Coke & Chemical Company, dated November 21, 1950, pp. 7-8: "The Company has a contract with Pittsburgh Steel Company and North Range Mining Company under which North Range Mining Company will undertake the development and operation of certain iron ore properties from which the Company will receive an estimated annual tonnage of approximately 80,000 tons of ore. The Company and Pittsburgh Steel Company will pay the entire cost of the development and operation of the mine and, in return, will receive one-half of all ore produced. The remaining one-half of the ore produced will be sold to North Range Mining Company at cost, with the provision that such ore will be resold to the Company and to Pittsburgh Steel Company at market price." The mine in question is in Iron County, Mich., on what is known as the "Warner Property." Pittsburgh Steel's share of the ore obtained is 60 percent. The agreement between the two Pittsburgh companies and North Range, dated August 31, 1950, is a part of Pittsburgh Coke & Chemical Co.'s Form S-1 Registration Statement under the Securities Act of 1933, dated July 3, 1951, exhibit 15-j. An agreement dated November 26, 1948, had provided for exploration of the property by North Range.

The only ore merchant to report contracts with Pittsburgh Steel was Hanna Coal & Ore Corp. One contract, covering the years 1951 through 1965, provides that Hanna will supply 75 percent of Pittsburgh's total requirements of manganiferous iron ore for use in its Monessen plant, but no more than 150,000 tons per year. A second contract, extending from 1949 through 1957, provides that for the first 3 years Hanna will supply 6 percent of Pittsburgh's total requirements of blast furnace ore for its Monessen plant—with a maximum limit of 75,000 tons annually; thereafter Pittsburgh will be supplied with 50,000 tons of ore annually.

these activities" having "resulted in the acquisition of one iron ore mine, which began production in 1951. The Company's proportionate interest in this mine" was "estimated to be in excess of 800,000 gross tons."

The Company's long term iron ore purchase contracts—

it was reported—

are with the Oliver Iron Mining Company * * *; the Hanna Coal & Ore Corporation * * *; and The Cleveland Cliffs Iron Company * * * These contracts give the Company the right to buy iron ore at competitive market prices. The maximum tonnage of ore available to the Company from these contracts during their life is in excess of 16,000,000 gross tons.[90]

While it is not proposed to discuss these contracts in detail, it is worth noting that during the 15-year term of its contract Oliver has the right to deliver ore from foreign sources, and that in 1964 and 1965, when the largest tonnages will be available from Oliver, Pittsburgh Steel—if it takes the full amount to which it is entitled under the contract—will be receiving from United States Steel 800,000 gross tons of ore each year.[91] Pittsburgh Steel has obviously found one of the richest of "new sources" of ore.[92]

Some of the other companies have long-term contractual relations with the ore merchants. International Harvester Co. has such contracts with Cleveland-Cliffs.[93] Sharon Steel Corp. has a similar arrangement with United States Steel Corp.[94] Portsmouth Steel Corp., before the land, buildings, and equipment constituting its

[90] Pittsburgh Steel Co., prospectus of July 16, 1951, p. 12.

[91] Pittsburgh Steel Co., Form S–1 Registration Statement under the Securities Act of 1933, dated June 25, 1951, exhibit 15–L–1.

[92] Cf. idem, prospectus of April 7, 1948, p. 13: "At December 31, 1947, the Company's rated annual ingot capacity was 1,072,600 net tons. Of the thirteen companies having larger ingot capacities than the Company, two had rated annual ingot capacities of 31,200,000 net tons and 13,800,000 net tons, respectively, and the remaining 11 had capacities ranging from 1,115,000 net tons to 8,600,000 net tons. The Company competes in the sale of its products with most of such companies, and also with smaller companies."

[93] Until 1947 International Harvester owned leases on three operating iron-ore mines in the Mesabi. At that time these leases were transferred to Cleveland-Cliffs Iron Co., which, as operator of the mines, undertook to provide the company's iron-ore requirements until the end of 1970. In its report on contractual arrangements with International Harvester, Cleveland-Cliffs stated that, between 1939 and 1970, it was responsible for the "annual delivery of a tonnage of high phosphorus and silicious ores equal to International Harvester's requirements of these grades of ore less any tonnage of these ores International Harvester receives from its own properties or interests."

For 1951 the amount of this ore was reported as approximately 70,000 tons. Cleveland-Cliffs also agreed to supply the "requirements of Standard Blast Furnace ores less any tonnage Harvester receives each year from properties in which it has an interest and less 33⅓% of Harvester's annual requirements, at its option, in a certain property in which it has an interest is not developed."

Shipments under this agreement for 1951 reportedly amounted to approximately 660,000 tons. International Harvester also has a contract for small amounts of ore from Hanna Coal & Ore Corp. which extends through the year 1954. Minimum and maximum limits of 40,000 and 50,000 tons annually were set for the years 1948 and 1949, and of 60,000 and 100,000 tons for the years 1950–54, inclusive, with the privilege accorded to International Harvester of determining the amounts to be shipped within the applicable ranges.

Besides these ore contracts, International Harvester has a "pig iron supply" agreement with Pittsburgh Coke & Chemical Co., under which it is to receive "150,000 tons of pig iron in approximately equal monthly installments of 2,500 tons over a period of five years commencing July 1, 1952, and ending June 30, 1957." In a loan agreement of the same date as the supply agreement (November 23, 1951) International Harvester agreed to lend Pittsburgh Coke $1,500,000 to assist it in financing additional facilities for the production of pig iron (amendment No. 1, dated November 27, 1951, to Form S–1 Registration Statement (No. 2–9281) under the Securities Act of 1933, dated November 13, 1951, exhibits 13–bb and 13–cc).

[94] Sharon Steel Corp. had no continuing source of iron-ore supply other than open-market purchases until late in 1945, when it purchased the Farrell (Pa.) Works of Carnegie-Illinois Steel Corp., a subsidiary of United States Steel. At that time arrangements were made with other "subsidiaries of United States Steel Corporation to supply the Farrell plant with iron ore for a period of ten years and with coke until" Sharon could "provide its own supply" (Sharon Steel Corp., prospectus of April 24, 1946, p. 8). In its report on future contracts, United States Steel reported that, through 1955, it had agreed to supply Sharon with ore ranging from a minimum tonnage of 275,000 tons to a maximum of 1.1 million tons annually.

Shortly after the Farrell plant was purchased, Sharon said: "When the operation of the Farrell Works is thoroughly coordinated with Sharon's finishing mills, it is anticipated that the company's steel plant and blast furnace at Lowellville will be disposed of" (annual report for 1945). They are, however, still being operated by Sharon, and ore for the 100-year-old Mary Furnace as well as for the blast furnaces at Farrell is now assured through 1965 under a contract apparently negotiated since United States Steel's report to the Commission, referred to above. (Cf. Sharon Steel Corp., prospectus of October 29, 1951, p. 5: "With the exception of approximately 8,000 tons per year of lump ore, the Corporation obtains its requirements for iron ore from Oliver Iron Mining Company, a subsidiary of United States Steel Corporation, under contractual arrangements which provide that Oliver will supply the Corporation with its present requirements for iron ore through 1965, at prices not less favorable than prices available to other purchasers.")

steel plant were acquired by Detroit Steel Corp. in January 1950, had long-term contracts with Cleveland-Cliffs and Steep Rock Iron Mines, Ltd., providing ore in an amount that seems to have been fully adequate to supply its blast furnace. These contracts were assigned to Detroit.[95] In view of the facts that Portsmouth Steel's investments include approximately 25 percent of the outstanding common stock of Detroit Steel and slightly more than 10 percent of the common stock of Cleveland-Cliffs;[96] that Cyrus S. Eaton is chairman of the board and a director both of Portsmouth Steel and of Steep Rock Iron Mines and is a director of Cleveland-Cliffs; and that William R. Daley, vice president, treasurer, and a director of Portsmouth, is also a director of Detroit Steel and of Steep Rock, Detroit would appear to be justified in a reasonable optimism regarding future ore supplies. Ford Motor Co. has, so far as is known, no mines and no interests in mines currently under operation, and is thus heavily dependent upon the ore merchants for its ore requirements.[97]

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[95] Cf. Detroit Steel Corp., Form 8-K Report to SEC, dated February 3, 1950, exhibit A, "Notice and Proxy Statement for Special Meeting of Stockholders November 28, 1949:

"Portsmouth's present requirements for iron ore are covered by the following contracts which Portsmouth will assign to Detroit.

"1. A contract with The Cleveland-Cliffs Iron Company, expiring in 1951, which provides for 450,000 tons of blast furnace ore per year.

"2. A contract with The Cleveland-Cliffs Iron Company, expiring in 1951, which provides for 10,000 tons of open hearth lump ore per year.

"3. A ten year contract with Steep Rock Iron Mines, Limited, starting in 1953, which provides 100,000 tons of ore per year.

"A fourth contract, which is in process of negotiation, would be a ten-year contract between Detroit and The Cleveland-Cliffs Iron Company, starting in 1952, and would cover the requirements of the Portsmouth Works, but would include the 100,000 tons per year covered by contract No. 3 above."

[96] Portsmouth Steel Co., annual report for 1951, p. 2.

[97] The Iron and Steel Works Directory for 1930 reported Ford Motor Co. as owning two iron-ore mines in Michigan. The next three editions of this directory, those of 1935, 1938, and 1945, listed only one of these mines among Ford's raw material properties. In 1935 and 1938 its annual capacity was given as 300,000 tons, in 1945 as 336,000 tons of ore. The two directories issued since 1945 (in 1948 and 1951) do not show Ford as having any iron mines.

The Mining Directory of Minnesota for 1939 indicated that since the issuance of the previous year's edition Ford Motor Co. had become the lessee of two reserve properties on the Mesabi Range, the available tonnages of which in May 1938, together amounted to about 1.8 million tons. Within a year Ford had acquired another reserve property on the Mesabi. The available tonnage was reported as "unknown," but it was later estimated as 1.87 million tons. Available tonnages of the three reserve properties in May 1945, as given in the Mining Directory of Minnesota for 1946, totaled 8.86 million tons. (This is still the estimated tonnage of the properties in question, which have not yet been developed.)

Ford seems to have held its three leases until some time in 1947, when they were acquired by Western Mining Co. (managed by Pickands Mather), though whether or not from Ford has not been ascertained (Mining Directory of Minnesota, 1939, 1940, 1945–48, 1952). Youngstown Sheet and Tube, which has the largest stock interest in Western Mining (50 percent; the remaining interest is equally divided between Dalton Ore and Steel Co. of Canada), first listed the company in its Annual Report for 1947 (p. 18) among companies partially owned.

In a letter dated February 28, 1937, which was one of the exhibits concerning which there was testimony before the Temporary National Economic Committee in 1939, an executive of Cleveland-Cliffs (A. C. Brown, then vice president) expressed apprehension concerning the possible effect of Ford's ore buying, writing that "it is becoming more and more likely that the large order placed by Ford each year at cut prices may become the accepted market price." Elton Hoyt II of Pickands Mather, whose testimony was also received in 1939, told the committee: "Ford Motor Co. has part of its own ore supply and buys relatively small tonnage. They always send out formal inquiries when they are about to buy ore" (TNEC hearings, pt. 18, pp. 10335, 10370, 10445).

Currently, however, Ford is understood to have no operating mines (Iron and Steel Works Director, 1951, lists no raw material properties for Ford) and to be dependent upon open-market purchases for all of its ore requirements not covered by certain long-term contracts. United States Steel reported a term contract with Ford, expiring in 1953, for annual shipments of 550,000 tons. (In 1949 United States Steel made only spot sales to Ford, which was thus supplied with 179,362 tons of ore.) Hanna Coal & Ore Corp. reported three contracts with Ford: one, extending from 1948 through 1953, for a minimum tonnage of 225,000 tons and a maximum of 275,000 tons annually of manganiferous ore; another, from 1949 through 1958, for a minimum amount of 60,000 and a maximum of 100,000 tons per year of nonbessemer ore; and a third, from 1949 through 1958, for a minimum of 60,000 tons and a maximum of 100,000 tons annually of high-phosphorous iron ore. Clearly, Ford is in an insecure position with respect to its ore supplies.

Some steps toward improving its status have lately been taken; but the deposits in the development of which Ford is now participating require beneficiation. Cf. Cleveland-Cliffs Iron Co., Annual Report for 1951, p. 7:

"Paralleling the development of taconite in Minnesota, we have made excellent progress in working out metallurgical processes for the beneficiation of similar iron formation in Michigan called jasper. We own large deposits of jasper on the Marquette Range, some of which can now be mined and beneficiated by presently known methods to produce a high grade blast furnace feed on a sound, economical basis.

"Arrangements have been completed to open up one of these deposits in the western part of the Marquette Range. Humboldt Mining Company, jointly owned by The Cleveland-Cliffs Iron Company and Ford Motor Company, has been formed to develop this property, which will be operated by us."

Regardless, however, of the results obtained by Humboldt Mining Co., it should prove advantageous to Ford to have established a connection with Cleveland-Cliffs.

In general, such long-term arrangements with the ore merchants as have been described provide less security for the smaller users than for the nine major steel companies because the latter are not only the big buyers of iron ore; they are also involved in partnership relations with the ore merchants through joint ownership of mines. In consequence, the first loyalty of the ore merchants is to the larger steel companies. In the event of a serious tightness in ore supplies, it would only be reasonable to expect that the first efforts of the ore merchants would be to supply the major steel companies.

The merchant pig-iron producer is strategic in the iron and steel industry, since he constitutes the one independent source of pig iron for the semi-integrated units in the steel industry as well as for the iron and steel foundries. While the integrated companies also sell pig iron on the open market, such sales are only of their surplus pig; and as soon as demand conditions tighten in the industry, the integrated companies absorb larger quantities of their pig production in their own operations.[98] Thus, the continuance of the merchant pig producers is essential to the maintenance of the smaller independents in the iron and steel industry.

In both absolute and relative terms the merchant pig producers have steadily become a decreasingly significant factor in the industry. In 1926, for example, there were 134 merchant furnace locations with a capacity of 16.4 million tons, representing 27.9 percent of total blast furnace capacity.[99] By 1948 there were in the United States only 14 pig-iron producers not integrated with steel making facilities.[1] Their combined blast furnace capacity was in the neighborhood of 4.7 million tons or only 6.8 percent of total pig-iron capacity. Of these 14 producers, more than half were either in some degree captive, in that they were controlled by users of pig iron, or had long-term commitments which limited the availability of their products and restricted their functioning as genuine merchant furnaces.[2] Sloss-Sheffield Steel & Iron Co. was, and still is, a subsidiary of United States Pipe &

[98] Conversely, in periods of economic depression, these integrated companies have had surplus pig which has been thrown on the market. The impact of this competition upon the independent merchant pig producers has been disastrous.

[99] Derived from Iron and Steel Works Directory of the United States and Canada, 1926.

[1] Pig-iron producers not integrated with steel-making facilities, listed by the American Iron and Steel Institute (in the Iron and Steel Works Directory of the United States and Canada, 1948) as active on January 1, 1948, were as follows:

Company	*Annual blast furnace capacity (net tons)*
Interlake Iron Corp.	1,244,860
Woodward Iron Co.	526,170
Missouri-Illinois Furnaces, Inc.	465,000
Sloss-Sheffield Steel & Iron Co.	423,270
Shenango Furnace Co.	417,300
Lone Star Steel Co.	394,800
Pittsburgh Coke & Chemical Co.	291,600
Kaiser & Frazer Parts Corp.	182,500
Eastern Gas and Fuel Associates	176,400
Tonawanda Iron Corp.	171,000
E. & G. Brooke Iron Co.	151,200
Globe Iron Co.[a]	90,000
Jackson Iron and Steel Co.[a]	90,000
Tennessee Products & Chemical Corp.[b]	73,920
Total	4,698,020

[a] These companies are listed as producing ferro-alloys. It is understood that the production is largely high-silicon pig, very much in demand by the foundries because of the large proportion of steel scrap which they have to use in producing foundry iron.

[b] Charcoal pig iron capacity, 40,320 net tons; ferromanganese capacity, 33,600 net tons.

[2] The existence of this situation serves to emphasize the difficulties of consumers of pig iron, from semi-integrated steel companies to small foundries, and also indicates the insecurity of certain furnace companies.

Foundry Co.;[3] Tonawanda Iron Corp. stood in the same relationship to American Radiator & Standard Sanitary Corp.[4] Kaiser & Frazer Parts Corp., subsidiary of Kaiser-Frazer Corp., was lessee of the blast furnace property of Struthers Iron & Steel Co.[5] E. & G. Brooke Iron Co.'s production, to the extent of about 90 percent, was divided among the three companies by which it had been jointly controlled since late in 1947.[6] Shenango Furnace Co., though an independent merchant furnace in the sense that it is not controlled by others, had a wholly owned subsidiary, Shenango-Penn Mold Co., with an annual productive capacity for iron ingot molds and stools of 425,000 tons. The annual pig iron capacity of the parent company was 417,300 net tons. However, Shenango had contracts covering part of the pig-iron requirements of Shenango-Penn.[7]

Pittsburgh Coke & Chemical Co., Interlake Iron Corp., and Eastern Gas and Fuel Associates each had part of its pig iron production committed through long-term contracts, as each continues to have. The lease of Struthers Iron & Steel Co.'s furnace to Kaiser-Frazer has already been mentioned. But in 1948 Pittsburgh Coke was also under contract to supply not less than 21,000 or more than 84,000 tons of pig iron per year[8] to Shenango-Penn Mold's Neville Island plant adjacent to its own Neville Island blast furnace.[9] Inter-

[3] United States Pipe & Foundry had been a substantial customer of Sloss-Sheffield before acquiring approximately 42.6 percent of the voting stock in 1942. Since July 1947, United States Pipe & Foundry has held a 54.87-percent interest in Sloss-Sheffield, which was reported in 1951 to constitute for its parent "a major source of supply * * * for raw materials." In 1948 Sloss-Sheffield's gross sales, less discounts, returns, and allowances amounted to $25,275,513.31, of which $8,791,921.16 represented sales of pig iron to its parent. In 1951, when gross sales exceeded those of 1948 by over $5,000,000, sales of pig iron to United States Pipe & Foundry were more than 43 percent of total sales (United States Pipe & Foundry Co.: Form 8-K reports to SEC, dated January 6, 1943, and May 28, 1951; Form 10-K reports to SEC for 1942, 1947. Sloss-Sheffield Steel Co., Form 10-K reports to SEC for 1942, 1947, 1948, 1951.)

[4] Although Tonawanda's operations were integrated with those of the parent company, it is understood to have sold on the open market some of the pig iron produced. Cf. American Radiator & Standard Sanitary Corp., annual report for 1948 (p. 10): "During the year, Tonawanda Iron Corporation was dissolved. Its business, properties and assets were taken over by the Corporation and are now operated as the Tonawanda Iron Division."

[5] "It was particularly important," said Kaiser-Frazer Corp. in its annual report for 1947, "for an independent automobile producer to be as nearly self-sufficient as possible during the critical postwar period. To obtain this objective," the report continued, the company took certain "decisive steps," among which were the following:

"Leased and operated a blast furnance at Struthers, Ohio, for production of pig iron.

"Arranged to obtain pig iron from the newly constructed plant of the Lone Star Steel Corporation at Daingerfield, Texas."

Struthers Iron & Steel Co. was a subsidiary of Pittsburgh Coke & Chemical Co.; and the lease of Struthers' furnace reduced by approximately three-eighths, for the term of the lease (which was for 3 years ending August 31, 1949), the blast furnace capacity controlled by Pittsburgh Coke. If Kaiser-Frazer made any open-market sales of pig iron produced at the Struthers furnace, it is doubted that their volume was considerable.

[6] "All through the year," wrote E. & G. Brooke Iron Co. in its annual report for 1947 (pp. 3-4), "the pig iron supply was far below consumer's requirements. * * * The shortage of pig iron became so acute that some of the larger consumers of merchant iron took active means to help their situation. * * * your Company entered into an agreement as of November 1, 1947, with Lukens Steel Company of Coatesville, Pa., Worth Steel Company of Claymont, Del., and Warren Foundry & Pipe Corporation of Phillipsburg, N. J., whereby they agreed to purchase each month all but 1,000 tons of our product (approximately 90%) for five years * * * In conjunction with this contract the three corporations offered to purchase from the stockholders of the Company any or all of their stock at $16 per share." The interests of the three companies were to be: Lukens, 48 percent; Worth, 32 percent; Warren, 20 percent. Slightly more than 70 percent of Brooke's outstanding shares were tendered. Pig iron was apparently supplied to the three companies on the basis of their proportionate interests (cf. Lukens Steel Co., Annual Reports for 1947 and 1948; Warren Foundry & Pipe Corp., annual reports for 1947 and 1948; Colorado Fuel & Iron Corp., prospectus dated December 6, 1951).

[7] Cf., for details, discussion of Crucible Steel Co., supra, and references elsewhere to Shenango's relations with Pittsburgh Coke & Chemical Co.

[8] These were the minimum and maximum of the original contract, which also, however, limited Pittsburgh Coke's obligation to the conversion into pig iron of a tonnage of ore no greater than 22½ percent of the requirements of its Neville Island blast furnace. A modification of the contract late in 1940 purported to increase the obligation, but is difficult to interpret. Cf. Pittsburgh Coke & Chemical Co., prospectus of November 8, 1944, p. 6: "* * * under a ten-year contract expiring in 1949, the Company furnishes all of the pig iron used by The Shenango Furnace Company in its ingot mold plant located near the Company's plants on Neville Island."

[9] Since 1949, when the lease of Struthers' furnace to Kaiser-Frazer and the 10-year contract with Shenango Furnace expired, Pittsburgh Coke's commitments to consumers of pig iron have greatly increased, though most of them were specifically made in contemplation of the erection of a new blast furnace of approximately 300,000 net tons capacity, scheduled for completion not later than July 1, 1952. There is a possibility, however, that the tonnage indicated will not represent a long-run net increase in capacity.

In November 1948, Pittsburgh Coke entered into an agreement with General Motors Corp., in accordance with which Struthers Iron & Steel Co. leased its blast furnace to General Motors for a 5-year period

lake Iron Corp., by the terms of an agreement originally entered into for a period of 10 years beginning January 1, 1926 (when it was By-Products Coke Corp.), and several times extended, was committed to selling up to 13,000 tons of iron per month to Valley Mould & Iron Corp., one of the largest independent producers of pig iron ingot molds and stools, with plants at Cleveland and Hubbard, Ohio, and South Chicago, Ill.[10] Eastern Gas and Fuel Associates, operating at Everett, Mass., the only blast furnace in New England, appears to have had virtually its entire production of pig iron committed under 5-year contracts, and hence not available for open-market sale.[11]

The decline in merchant pig-iron capacity, already noted as having been conspicuous in the period from 1926 to 1948, has continued. During the years since 1948, two companies whose blast furnaces were not integrated with steel-making facilities have become so integrated, and another is in the process of withdrawal from the merchant pig-iron field. E. & G. Brooke Iron Co., more than 70 percent of whose pig-iron production had been contracted for late in 1947 by two semi-integrated steel companies, was acquired in January 1952 by Colorado Fuel & Iron Corp.[12] Missouri-Illinois Furnaces, Inc.,

expiring August 31, 1954. "The Struthers blast furnace is, however, operated by the Company under an operating agreement with General Motors Corporation; under such operating agreement and other agreements with General Motors Corporation, the Company has agreed to operate the Struthers blast furnace, to secure raw materials for the production of pig iron and to sell at least 750,000 gross tons of pig iron to General Motors Corporation over the five-year term of the lease; * * *" As to the future of the Struthers furnace, Pittsburgh Coke has said: "The Struthers blast furnace is not integrated with the Company's other operations and is a marginal producer. Whether the Company continues the operation of the Struthers blast furnace following the expiration of the General Motors contracts in 1954 depends upon the price of and demand for pig iron at that time as well as the availability of iron ore" (Pittsburgh Coke & Chemical Co., prospectus of July 23, 1951, p. 9).

In a prospectus dated December 3, 1951, Pittsburgh Coke, reported (pp. 4–5): "The Company has entered into agreements with three of its pig iron customers, James B. Clow & Sons, Westinghouse Airbrake Company and International Harvester Company, whereby such customers agree to loan the Company from time to time on or prior to December 31, 1951, in the aggregate $2,550,000, such loans to be evidenced by 3% notes due July 1, 1958. Such loans are to be made by the lenders from time to time as set forth in the agreements. Such agreements also provide for the sale by the Company and the purchase by the customers of varying quantities of pig iron over a five year period. The Company has agreed to pay such notes at the rate of $10 for each ton of pig iron delivered to the lenders pursuant to the provisions of the agreements." The period during which pig iron is to be supplied pursuant to these agreements is from July 1, 1952, to June 30, 1957. Among the three customers 51,000 tons of pig iron are to be divided annually; the to n ges to which they are entitled are: James B. Clow & Sons, 9,000 tons; Westinghouse Air Brake Co., 12,000 tons; International Harvester Co., 30,000 tons. During the same period, under a contract with Shenango and Shenango-Penn Mold, the latter "will have the right to take up to 16,000 gross tons of pig iron per month," or 192,000 tons per year. Thus 243,000 tons out of the 300,000-tons annual capacity of the new blast furnace were committed before the additional pig-iron facilities were completed. It has been stated that Pittsburgh Coke "plans to sell the remainder of the production from the Neville Island furnace to steel mills and foundries in the Pittsburgh area. (Op. cit., pp. 14–15. The various contracts with General Motors, the contracts with Shenango and Shenango-Penn, and with Clow, Westinghouse Air Brake, and International Harvester are exhibits to Pittsburgh Coke & Chemical Co.'s Form S–1 Registration Statements under The Securities Act of 1933, dated July 3, 1951, and November 13, 1951, and amendment No. 1 (dated November 27, 1951) to the latter.)

"For the year ended December 31, 1951, of the total pig iron sold by the Company 36% was sold to General Motors Corporation and 21% was sold to Shenango-Penn Mold Company" (Pittsburgh Coke & Chemical Co., prospectus of April 18, 1952, p. 15).

[10] The contract called for the delivery of molten iron from Interlake's South Chicago plant to the adjacent plant of Valley Mould. The quantity involved was slightly more than one-eighth of Interlake's total pig-iron capacity; and in a letter to Valley Mould extending the agreement through 1946, Interlake spoke of having "enjoyed greatly the large volume of business." So far as Interlake's South Chicago plant is concerned, nearly 35 percent of its blast-furnace capacity would be required to produce the maximum tonnage of molten iron to which Valley Mould is entitled under the contract. (Interlake Iron Corp., Form 10–K Report to Securities and Exchange Commission for 1951, exhibit A, includes a copy of the contract as amended in 1935, and copies of two letter agreements extending the contract. The latest of these extensions is to December 31, 1952.)

[11] Two annual reports of Eastern Gas and Fuel Associates give such information as is available concerning the contracts in effect in 1948 and at present. That of 1947 said (p. 7): "Effective July 1, 1947, we entered into satisfactory five-year contracts with almost all of the pig iron users in New England. These contracts permitted capacity production and indications are that we will continue to operate the blast furnace profitably for some time to come. Without this production, New England foundries would have serious difficulties in operating during the present critical shortage of pig iron." In the report for 1951 it was stated (p. 5): "Our long-term contracts with customers, which have helped to assure continuous operation of the blast furnace and which were due to expire June 30, 1952, have been extended for an additional five years to June 30, 1957." Fortunate as are those who have contracts, prospective "pig iron users in New England" will have to arrange for pig-iron supplies from sources outside that region, since the blast furnace of Eastern Gas and Fuel Associates is the only one in New England.

[12] Cf., supra, discussion of Colorado Fuel & Iron Corp., and of the pig-iron supply contract made with Brooke by Lukens, Worth, and Warren Foundry.

was purchased in February 1951 by the semi-integrated Granite City Steel Co., which had for several years been receiving most of its pig iron from the neighboring blast furnaces of Missouri-Illinois.[13] Lone Star Steel Co., having been at the outset (it began operations in 1947) [14] a merchant furnace, took steps early in 1950 toward building a cast-iron pipe foundry which would utilize some of its pig iron. It also announced that its "broad program for plant expansion" contemplated "the addition of steel making and rolling facilities" and that the management was about to "concentrate its energies toward realization of a fully integrated steel producing plant." [15] The foundry was placed in operation before the end of 1950; and in his letter accompanying the company's annual report for 1951, the president said that construction of the new steel plant was "progressing at a rapid rate." Ingot capacity of the plant, it was stated in the report, would be 500,000 tons annually.[16]

Subsequent to 1948, a blast furnace at Chester, Pa., was revived and operated by Allied Iron Works, Inc., but it was soon acquired by a small semi-integrated steel company.[17]

As in the case of the major steel producers, the position of the merchant pig producers with respect to access to iron ore varies greatly from one to another. By far the largest of these companies is Interlake Iron Corp., which controls over 25 percent of the total merchant blast furnace capacity. In 1948 it had a capacity of 1.2 million tons out of the total of 4.6 million tons. The principal stock-

[13] Cf. Granite City Steel Co., prospectus of April 3, 1951 (p. 5): "The Company obtains pig iron from the pig iron and coke plant acquired recently * * *, a part of the pig iron production of such plant being sold to others. The Company is informed that sales in 1950 of products produced in such plant totaled approximately $20,000,000, of which approximately 39% was pig iron sold to the Company, 56% pig iron sold to others, and 5% coke and coke by-products."

Granite City's current expansion program, "expected to be completed in 1953 * * * involves the addition of three new open hearth furnaces, * * *" (Granite City Steel Co., Annual Report for 1951, p. 8).

[14] The Government's plant at Daingerfield, Tex., was leased from War Assets Administration for 3 years from March 31, 1947, with an option to purchase within 2 years of that date. As of March 10, 1948, Lone Star exercised its option. The acquisition was made effective as of January 1, 1948.

[15] Lone Star Steel Co., Annual Report for 1949 (dated April 12, 1950). "Since mid-1949," Lone Star wrote in 1950, "the Company has made a concerted effort to secure * * * local foundries in its primary trade area as regular customers, and at the present time the major portion of the Company's regular sales is made to such foundries." Referring to the proposed foundry, it was said: "The operation of such foundry will not impair the sales volume of pig iron. It is anticipated that the cast iron pressure pipe foundry will require 72,000 tons of pig iron annually, which amount is approximately 18% of the Company's total annual rated capacity. The production of such pipe will enable the Company to more nearly utilize the capacity of its furnace without impairing its sales volume of pig iron" (Lone Star Steel Co., prospectus dated March 16, 1950 included in Form S-1 Registration Statement effective same date.)

About a year later, speaking of the contemplated addition of steel-making facilities, Lone Star said:

"Upon completion of the proposed steel mill, the Company will in effect be embarking upon a new operation and will have only a comparatively small amount of merchant pig iron for sale to others, unless it becomes economical from time to time to utilize a high scrap charge in the open hearth and foundry operations. Although the utilization of scrap, based upon current prices for scrap and pig iron, tends to increase the cost of steel production, the profit from the sale of additional pig iron will more than offset such increased cost. * * *

"Since the production of pig iron was commenced in October 1947, the Company has served more than 350 pig iron customers. Its primary trade territory for pig iron, the area in which the company enjoys a freight rate advantage over other merchant pig iron producers, encompasses the major part of the States of Texas, Oklahoma, Arkansas and Louisiana. In addition to the regular customers in this area, the Company is presently shipping pig iron to certain major industrial centers throughout the United States" (Lone Star Steel Co., prospectus dated April 4, 1951).

[16] Lone Star's pig-iron capacity in 1951 was 366,600 net tons (American Iron and Steel Institute, Iron and Steel Works Directory of the United States and Canada, 1951).

[17] This furnace was listed in the Iron and Steel Works Directory of the United States and Canada, 1938, under Delaware River Steel Co. but was stated to have been last operated in 1930. The annual pig-iron capacity was given as 108,000 tons. It was rebuilt and relined in 1942, and for a short time was operated, under lease from the Defense Plants Corporation, by Pittsburgh Ferromanganese Co., a wholly owned subsidiary of Pittsburgh Coke & Chemical Co. The lease was canceled in 1943 because of "inability of getting allocations of [ferromanganese] ores to this furnace" (Pittsburgh Coke & Chemical Co., Annual Report for 1943, p. 3). The Iron and Steel Works Directory for 1945 gave an annual pig-iron capacity for this blast furnace of 127,000 net tons. It was not listed in the next (1948) edition of the directory.

Barium Steel Corp. acquired the furnace in 1950. Cf. Barium Steel Corp., Form 10-K Report to Securities and Exchange Commission for 1951, which stated that the blast furnace properties of Allied Iron Works, Inc., acquired in August 1950, by Central Iron & Steel Co., a wholly owned subsidiary of Barium, "after extensive changes and improvements, commenced operation in June 1951. The plant," it was said, "is operated at Chester, Pennsylvania, by Chester Blast Furnace, Inc., a wholly owned subsidiary of Central Iron & Steel Co. * * *" The Iron and Steel Works Directory, 1951, states its annual pig-iron capacity as 200,000 net tons.

holder in Interlake Iron is Mather Iron Co., which in turn is affiliated with Pickands Mather & Co., the largest ore merchant in the United States.[18] With these connections it is obvious that Interlake is fortunately situated with respect to its iron ore supply.[19]

Shenango Furnace Co., Sharpsville, Mercer County, Pa., is one of the few independent blast furnaces left in an area where pig iron has

[18] Interlake Iron Corp. obtains its ore principally from the Dalton Ore Co., in which it has a 70-percent interest. "Dalton Ore Co. * * * has interests (through stock ownership or otherwise) in a diversified group of iron ore properties located in the Lake Superior district" (Interlake Iron Corp., 1950 annual report). The remaining 30-percent interest in Dalton appears to be owned by Pickands Mather. In 1939, at any rate, according to the testimony of Elton Hoyt II ("manager and partner" in Pickands Mather) before the Temporary National Economic Committee, Pickands Mather owned 30 percent of the total stock but 60 percent of the voting stock of Dalton Ore. (In 1929, "the Pickands, Mather & Co.'s ore properties were put into Dalton Ore Co., and 70 percent of the stock was sold to Interlake Iron Corp. for its common stock." Pickands Mather's management contract with Dalton, so Hoyt reported, "runs for the life of the mines in which the Dalton Ore Co. is interested.") Pickands Mather had considered it necessary to hold a majority of the voting stock; but its control was "subject to the limitation that none of the properties of Dalton Ore can be surrendered, or new properties taken into Dalton Ore without the approval of Interlake Iron Corp." (TNEC hearings, pt. 18, pp. 10230-10233). All the mining companies in which Dalton has stock interests are (with apparently one exception) managed by Pickands Mather. This exception is Athens Iron Mining Co., of which Cleveland-Cliffs, which operates the property, owns 55.038 percent and Dalton 41.595 percent.

Interlake's Form 10-K Annual Report to the Securities and Exchange Commission for the Fiscal Year Ended December 31, 1950, under the heading (item 3), "Changes in the Business," gave the following information:

"On January 1, 1950, Dalton Ore Co. and Palmer Mining Co. became majority owned subsidiaries of the registrant as a result of the operations of the provisions of the certificate of incorporation of Dalton Ore Co. Pursuant to said provisions, which became effective in 1929, the holders of the class A common stock of Dalton Ore Co. first became entitled to equal voting rights with the holders of the class B common stock of said Company on January 1, 1950, prior to which date the holders of the class B common stock were entitled to elect all the directors of that Company. The registrant owns and for a number of years has owned, all of the outstanding Class A Common stock and 40 percent of the Class B common stock of Dalton Ore Co. As a result, since January 1, 1950, the registrant has been and is now entitled to exercise 70 percent of the voting power of Dalton Ore Co. Dalton Ore Co. now owns and for a number of years has owned, 59 percent of the capital stock of Palmer Mining Co."

During 1951, Elton Hoyt II and John Sherwin, both Pickands Mather partners, and respectively president and a director, and vice president, treasurer, and a director of Mather Iron Co., were directors of Interlake Iron (the former was also a member of its executive committee), as they had been before the change with respect to voting control of Dalton Ore noted above. As of February 1, 1952, Mather Iron Co. was the largest—in fact, the only large—holder of Interlake's equity securities, holding of record and beneficially 17.19 percent, and beneficially only, 0.50 percent, of the common stock (the only class of securities) outstanding. As of April 29, 1952, there were 9,134 holders of common stock (Interlake Iron Corp., Form 10-K Annual Report Pursuant to Section 13 or 15 (d) of the Securities Exchange Act of 1934 for the Fiscal Year Ended Dec. 31, 1951). Pickands Mather owns all the common stock of Mather Iron Co. (Pickands Mather & Co.'s report to FTC), and Mather Iron Co. is "controlled by said partnership" (Interlake Steamship Co., Form 10-K Annual Report Pursuant to Sec. 13 of the Securities Exchange Act of 1934, for the Fiscal Year Ended December 1951).

Hoyt and Sherwin were, during 1951, officers of Dalton Ore and of Palmer Mining Co. "During 1951 Dalton Ore Company owned * * * stock of certain companies which are engaged in the mining, production, beneficiation, or treatment of iron ores. Messrs. Hoyt and Sherwin are officers of such companies." Hoyt was also a director of Olga Coal Co., in which Interlake, Inc., a wholly owned subsidiary of Interlake Iron, owns a 37-percent undivided interest and Youngstown Sheet & Tube a 53-percent undivided interest.

During the year 1951, Pickands Mather & Co. received from Interlake Iron remuneration of $762,743.67 "as (*a*) commissions as exclusive sales agent of [Interlake] on sales of pig iron, sales of domestic and foundry coke, and sales of coal from [Interlake's] Duluth dock, for collecting accounts of [Interlake] on sales of pig iron and coal and for guaranteeing and collecting accounts of [Interlake] on sales of coke; (*b*) for its services as managing and sales agent of Dalton Ore Co.; and (*c*) for services as managing agent of Palmer Mining Co."

Besides being Dalton's managing and sales agent, Pickands Mather attended to the transportation of Dalton's ore; and Dalton purchased from and exchanged ore with Mather Iron. Interlake Iron purchased coal from Pickands Mather as a distributor or as a sales agent.

Most of the ore, coal, and limestone for Interlake Iron was carried by Interlake Steamship Co., the business of which is managed and supervised by Pickands Mather & Co. as operating agent. During 1951, Hoyt and Sherwin and a third Pickands Mather partner, H. C. Jackson (who was also a vice president, secretary, and a director of Mather Iron), were directors of Interlake Steamship Co., holding respectively the offices of president, vice president and treasurer, and secretary, while E. C. Brunner, another Pickands Mather partner, was comptroller. "During 1951 Messrs. Hoyt and Sherwin were officers of The Interlake Steamship Company, the business of which is managed by Pickands Mather & Co., and they have advised that on February 1, 1952, they and their associates owned an aggregate of 9.48 percent of the outstanding stock of said Company" (Interlake Iron Corp., Form 10-K Annual Report for 1951). This seems to be a statement of the holdings in Interlake Steamship of the Pickands Mather partnership. As of February 1, 1952, Mather Iron "owned 35,000 shares of the common stock of the company" (Interlake Steamship Co., Form 10-K Annual Report for 1951), or 7.77 percent. Youngstown (with which Interlake Iron's subsidiary, Interlake, Inc., shares ownership of Olga Coal Co.; which owns stock in 11 ore-mining companies in which Dalton Ore also has an interest; and which owns wholly or in part five other mining companies for which Pickands Mather is managing agent) was, as of February 1, 1952, the largest holder of Interlake Steamship Co.'s equity securities, of which it held 13.92 percent of the common capital stock.

During 1951, Interlake Steamship "paid to Pickands Mather & Co. * * * $98,000 as compensation for its services as operating agent under a management contract. * * *" Interlake Steamship's officers serve "without salary as such" (Interlake Steamship Co., Form 10-K Annual Report for 1951).

[19] Interlake requires about 2 million gross tons of ore at its current rate of operations. The furnaces of the company are all on the Great Lakes, and enjoy cheap water connections to the mining properties held by its subsidiary, Dalton Ore, in the Lake Superior region. They also are favorably situated with respect to the large industrial consuming areas for their products.

been produced since at least as early as the 1830's. Its blast furnace capacity was 417,300 tons in 1948. As indicated in the discussion of Crucible Steel,[20] Shenango is a partner with Crucible in 50-percent ownership of the Snyder Mining Co. operating on the Mesabi Range in Minnesota. On the basis of the production by Snyder in 1948, Shenango was entitled to an amount in the neighborhood of 500,000 tons. Shenango also has a 3-percent investment interest in Mahoning Ore & Steel Co., one of the largest mining companies in the Lake Superior district, and managed by Pickands Mather. In its report, Pickands Mather stated that it made ore shipments to Shenango but did not indicate their volume. On the basis of its investment interest, Shenango was entitled to 3 percent, approximately 117,000 tons, of the 1948 production. Shenango also had a long-term contract for supplies with Oliver Mining.[21]

The Tonawanda Iron Corp., formerly a direct subsidiary of American Radiator & Standard Sanitary Corp., is now an operating division of that company. Its blast furnace at North Tonawanda, N. Y., with a capacity in 1948 of about 170,000 tons, provides iron primarily for the foundries of the parent corporation, but offers merchant iron to other foundries. American Radiator owns a 50-percent interest in the James Mining Co. in Michigan, operated by Pickands Mather. Shipments from James Mining in 1948 totaled 215,000 tons, of which Tonawanda's share was approximately 107,000 tons. The company also had long-term contracts with ore merchants.[22]

Globe Iron Co. and Jackson Iron & Steel Co., both with blast-furnace capacities of about 90,000 tons in 1948, have iron-ore mining properties in the Menominee Range of Michigan. Globe operates the Globe-Cornell mine, which produces high-silica ore and the annual capacity of which is reported to be 80,000 tons.[23] It also has a small contract for ore.[24] Jackson Iron & Steel Co.'s Bradley mine in the Menominee has an annual capacity reported as 200,000 tons.[25] No long-term contracts with Jackson were reported by any of the merchant ore houses. Apparently there is a considerable quantity of high-silica ore available for exploitation, and with the rather restricted demand for this type of ore it may be inferred that both Globe and Jackson, with their small ore requirements, have not had serious difficulty in obtaining supplies.

Pittsburgh Coke & Chemical Co. had an available blast furnace capacity in 1948 of 291,600 tons, which was that of its Neville Island plant. The furnace of its subsidiary, Struthers Iron & Steel Co., with a capacity of 182,500 tons, was, as has been indicated, under lease to Kaiser & Frazer Parts Corp. One of Pittsburgh Coke's principal suppliers of iron ore since at least as early as 1929 has been

[20] Cf. discussion of Crucible Steel Co., supra, for a summary of the contract between Crucible, Shenango, and Snyder Mining Co., information regarding Snyder's ore properties and Shenango as a seller of ore, and an account of the close relationship existing between Crucible and Shenango.

[21] This contract, extending from 1950 through 1955, provides for shipments to Shenango ranging from a minimum of 250,000 tons to a maximum of 450,000 tons annually, until 2,500,000 tons shall have been delivered, with the exact amount within the ranges to be determined by the buyer. The operation of Shenango's furnaces at full capacity calls for about 750,000 tons annually. In view of some of the more recent long-term contracts made by Oliver (e. g., that with Pittsburgh Steel), it seems reasonable to suppose that Oliver would be willing to continue selling ore to Shenango.

[22] Oliver Iron Mining Co. reported a contract with American Radiator, expiring at the end of 1952, for shipments of 120,000 tons annually. Hanna Coal & Ore Corp. also reported a contract for shipments, from 1948 through 1952, ranging from a minimum of 9,000 tons to a maximum of 18,000 of manganiferous ore each year.

[23] American Iron and Steel Institute, Iron and Steel Works Directory of the United States and Canada, 1948, 1951.

[24] This was with Hanna Coal & Ore Corp. which reported that, for the years 1949 to 1952, inclusive, it had agreed to supply Globe with between 15,000 and 20,000 tons of manganiferous iron ore annually.

[25] American Iron and Steel Institute, Iron and Steel Works Directory of the United States and Canada, 1948, 1951.

M. A. Hanna Co. Under a contract entered into in 1929 and running through 1948, Hanna undertook to supply 47.5 percent of the ore required for Pittsburgh Coke's blast furnaces, but with the proviso that Hanna was not obligated to sell more than 427,500 tons of ore in any one year. In early 1947, Pittsburgh Coke sold its Davidson mine, in Michigan, to Pickands Mining Co., reserving the right to purchase, until the end of 1962,[26] 30 percent of the output of the mine, but not exceeding 125,000 tons annually. In 1948 Pickands Mather, managing agent for Pickands Mining, supplied the company, under this contractual arrangement, with 103,000 tons of ore. The ore supply contract with Shenango Furnace which was in effect in 1948 has previously been discussed, as have later contracts with Shenango, as well as the partnership interests in mining companies and mining ventures (Orote Iron Co., North Range Mining Co.) in which Pittsburgh Coke and Pittsburgh Steel are associated. In July 1951, Pittsburgh Coke reported:

> Of the iron ore used by the Company at its Neville Island plant, 47½% is obtained from Hanna Coal & Ore Corporation under a contract which expires in 1954.[27] The remainder of the ore used by the Company at the present time is obtained under short term commitments with others or from a company (in which the Company has an interest) which owns substantial ore reserves. In addition, the Company has an option to purchase from Oliver Iron Mining Company its requirements of iron ore for the Struthers furnace during the continuation of the contract with General Motors Corporation. * * *
>
> The Company has recently negotiated a new contract with Hanna Coal & Ore Corporation which expires in 1969; the ore supplied under this contract is to be either Lake Superior or Labrador ore and the first deliveries * * * are to be made in 1955. This contract provides for the major requirements of the present Neville Island blast furnance and the new blast furnace * * * The Company's additional ore supply for the period following the completion of the new blast furnace and prior to 1955 will be secured from the present sources of ore, from a company (in which the Company has an interest) whose ore reserves are expected to be available in 1953 and under a short term commitment with Hanna Coal & Ore Corporation.[28]

The 1929 contract with Hanna Coal & Ore antedated Pittsburgh Coke's acquisition of an interest in Struthers Iron & Steel Co.[29] It is not known how the ore requirements of Struthers were supplied prior to the lease of its blast furnace properties to Kaiser & Frazer Parts Corp. During the period of the lease, however, the responsibility for purchasing the materials needed for operating the plant belonged to Portsmouth Steel, as Kaiser's agent under a management contract.[30] Since Portsmouth was obtaining its own ore from Cleveland-Cliffs and also had other than contractual relations with that company, it would seem strange if Cleveland-Cliffs did not provide at least some of the ore for the Struthers furnace.

Missouri-Illinois Furnaces, Inc., was organized by Koppers Co., Inc., and Hanna Coal & Ore Corp. to acquire the coke and blast furnace property at Granite City, Ill., which Koppers had been operating as lessee of the Government. As of October 31, 1947, the lease was suspended and the plant was operated by Missouri-Illinois. Early in 1948, however, the Department of Justice refused to approve the

[26] Cf. Listing Statements of the New York Stock Exchange, A-13619, Pittsburgh Coke & Chemical Co., November 21, 1950, p. 7, where Pittsburgh Coke gives a date 1 year earlier. Pickands Mather's report to the Commission states that Pittsburgh Coke "retained the right to purchase 30% of the ore * * * to and including the year 1962."

[27] Cf. Listing Statements of the New York Stock Exchange, A-13619, Pittsburgh Coke & Chemical Co., November 21, 1950, p. 7.

[28] Pittsburgh Coke & Chemical Co., prospectus dated July 23, 1951, pp. 11-12.

[29] In December 1950, Struthers, then about 90-percent owned by Pittsburgh Coke, was liquidated.

[30] Cf. for a copy of this contract, Kaiser-Frazer Corp., Form 8-K Report to Securities and Exchange Commission, dated October 10, 1946, exhibit B. At the time the contract was made, Kaiser-Frazer had a $2,000,000 investment in Portsmouth's common stock.

sale of the property to Missouri-Illinois if the corporation continued to be jointly owned. Koppers accordingly purchased, as of January 31, 1948, the 50-percent interest of Hanna, and Missouri-Illinois became a wholly owned subsidiary of Koppers.[31] During the period that Koppers had been operating the Granite City plant for the Government, Hanna had been one of the principal suppliers of ore for the furnaces, and it continued as such a source after the acquisition of the property by Koppers.[32]

In the course of the negotiations between Koppers and Granite City Steel looking to the purchase of the Missouri-Illinois property by the steel company, it appeared that, before Koppers purchased the interest of Hanna Coal & Ore in Missouri-Illinois, the partners had entered into an agreement providing that Koppers would not sell its interest in the plant without first offering it on certain terms to Hanna. In consideration of Hanna's waiving its right to be offered the plant before it should be sold to Granite City Steel, the steel company entered into certain ore purchase agreements with Hanna. While in consequence of the various ore agreements Hanna occupies the position of a preferred supplier, Granite City Steel is assured of a substantial future supply of ore.[33]

Most of the other pig-iron producers not integrated in 1948 with steel-making facilities are operating on low-grade deposits relatively near their plants or are mainly dependent upon the open market for their ore supplies. The former seems to be the situation of Woodward Iron Co., the second largest merchant producer, and of Sloss-Sheffield Steel & Iron Co., both operating in the southeastern district. It is also the case of Lone Star Steel Co., located in Texas,[34] and of the

[31] Early in 1949, Missouri-Illinois was formally dissolved.

[32] When the plant was sold to Granite City, Hanna was committed under a contract extending from April 1, 1950, to April 1, 1960, to supply Koppers with a "fixed tonnage at the rate of 10,000 tons per month multiplied by the number of calendar months or major fractions thereof for each Granite City, Illinois, furnace which Koppers operates in each month or major fraction thereof in each year" (report to FTC). The contract was assigned to Granite City.

[33] Cf. Granite City Steel Co., Form S–1 Registration Statement under The Securities Act of 1933, dated March 13, 1951, exhibit 15–d and accompanying exhibits A–D to exhibit 15–d.

A contract for ore from the Iron Mountain (Mo.) property of Ozark Ore Co., a Hanna subsidiary, provides for annual delivery of not less than 30 percent of Granite City's requirements (but a minimum of 150,000 tons, whatever the steel company's operating rate), though "not, however, in excess of the capacity of Hanna's mine and plant—shortly to be rated at 300,000 tons per annum." The term of this contract is "15 years, or until exhaustion of the Iron Mountain property, whichever sooner occurs."

Another contract, for ore from the Spring Valley mining area in southern Minnesota, running for 10 years from April 1, 1951, or until the exhaustion of the economic ore reserves controlled by Hanna in the area, provides for delivery of an annual tonnage "equivalent to 10,000 tons per month times the number of months each of the furnaces of Granite City Steel operates during each year,—not to exceed 300,000 tons."

Granite City's manganiferous ore requirements up to 75,000 tons per year are provided for in a 15-year contract for such ore from the Cuyuna Range.

If Granite City should exercise by April 1, 1951, an option granted by Hanna, Hanna would proceed to construct a pilot plant on its Groveland property in the Menominee, and, in the event of its satisfactory operation, then "erect a large-scale commercial plant and open up the Groveland property and sell from the production of the said property 500,000 tons of concentrates per year to Granite City Steel," beginning not later than 1955, and apparently continuing for 25 years. That the option was exercised seems to be indicated by the following passage from Hanna's Annual Report for 1951: "A pilot plant was put in operation late last year on the Groveland property in Dickinson County, Michigan, for the purpose of testing methods for beneficiating low-grade ores from Michigan, Wisconsin, and Minnesota. The results so far obtained, which confirm previous laboratory findings, indicate that a substantial operation in the Groveland area may be possible. This year's research work should develop some rather definite conclusions."

Cf. also, Granite City Steel Co., Prospectus dated November 27, 1951 (p. 6): "The Company has commitments for the purchase of ore under which it is believed the Company can obtain the ore to operate the existing blast furnaces at capacity for the next fifteen years."

[34] Lone Star, however, appears to be well satisfied with its situation. Cf. the following passage from its Annual Report for 1951: "The depletion of domestic iron ore reserves, and the intensive, world-wide search for new reserves, has been widely publicized in recent years. Lone Star faces no unusual problem in this respect. The company is situated near the center of a broad belt of iron ore extending through East Texas from the Oklahoma border to the Gulf of Mexico. These ores are low grade iron oxides (Limonite) and carbonates (Siderite) which are processed into high quality blast furnace ore through washing and other beneficiation. Your company has successfully used these ores for more than four years and is continuing its research activities toward greater utilization of the materials through improved beneficiation processes.

"The reserves of ore now owned, or leased, by Lone Star occur within a radius of 20 miles of the blast furnace. Although these reserves insure many years' supply of easily transported low cost ore, they are being continuously increased. This program is under the direction of the company's mining engineers and nationally recognized consultants."

E. & G. Brooke Iron Division (formerly E. & G. Brooke Iron Co.) of Colorado Fuel & Iron Co., which operates largely on New Jersey deposits.[35] Eastern Gas and Fuel Associates has been largely dependent upon the open market, and is not known to have at present any term contracts.[36]

Summary

In general, the iron ore supply situation of the smaller integrated steel companies and of the merchant pig iron producers is not encouraging. Some, such as (notably) Interlake Iron Corp. and Colorado Fuel & Iron Corp. so far as its western operations are concerned, appear to have ore resources sufficient for some time to come. Others have special connections with ore producers which give them a preferred status for a term of years, but which may be impermanent. A few have moderately substantial though even now inadequate reserves, and must either eschew expansion or accept increased dependence and insecurity. Most of the other companies which have some ore of their own are, however, operating with low-quality deposits which can be exploited only by the more costly underground mining methods, or which require concentration of low-grade ores before shipment. Still others among the smaller users of iron ore are entirely dependent upon purchases—a particularly hazardous position, since the close connections between the large steel companies and ore merchants mean that, in a squeeze, the first loyalty of merchants is to the big steel companies.

The short-term outlook for the independents is better than their long-term prospects. Most of them who have survived have done so by digging in along the crevices of the industry. Their access to iron ore is not such as to give them encouragement in expanding their operations, though it is enough to keep them going at the present time. This kind of predicament breeds neither independence of outlook nor competitive behavior. To a considerable extent the smaller users of iron ore exist by sufferance; they are hardly in a position to be a vital element in competition.

With the coming shift of the steel industry to foreign ores and perhaps to lower-grade domestic ores for much of its raw material, aggregations of capital will be required which appear to be beyond the reach of the independent merchant pig iron producer. In the evolving industrial structure it appears that the independent companies will have an even more tenuous position in the industry than they now hold.

THE ORE MERCHANTS

By 1948 the four major ore merchants had virtually become appendages to the large steel companies. This came about through the partnership arrangements which had been developed between these

[35] E. & G. Brooke Iron Co. in 1941 purchased the Richard mine and organized Richard Mining Co., a wholly owned subsidiary. Cf. the company's Annual Report for 1941, p. 3: "Early in the year we foresaw a shortage of ore for our furnace. We had formerly felt, as we could always get ores, that our small furnace operation was better off, without our owning a mine. Conditions had changed so much, however, that in March, 1941, we started negotiations to buy the Richard Mine, near Wharton, N. J. * * *" The estimated tonnage of available ore was 1,500,000, "with prospects of developing a larger tonnage."

[36] Hanna Coal & Ore Corp. reported two contracts with this company for the years 1948 to 1951, inclusive. One was for minimum tonnage of 275,000 tons and a maximum of 320,000 tons for the entire period, with the purchaser determining the quantity to be delivered each year. This contract calls for New York ore but permits the substitution of Minnesota ore. The other contract was for a minimum annual tonnage of 100,000 tons and a maximum of 125,000. The Iron and Steel Works Directory of the United States and Canada, 1948, 1951, indicates that the company has been using some foreign ore. The prospect for obtaining such ore is probably improving.

steel companies and the ore merchants for the exploitation of ore properties; and it has been further cemented by the long-term contractual arrangement between them for supplies of ore.

In 1948, Pickands Mather, the largest ore merchant, with shipments totaling nearly 14 million tons in that year, sold virtually no iron ore on the open market. Almost its entire distribution was controlled by the ownership arrangements prevailing between the company and iron ore users [37] (see chart XVI). Six of the nine largest steel producers held stock interests in mining companies managed by Pickands Mather resulting in shipments to them of 10.6 million tons—over 75 percent of Pickands Mather's total shipments.[38] The remaining tonnage also went to other users on the basis of their ownership interests in or their agreements with mining companies managed by Pickands Mather.[39]

Pickands Mather was unique in that virtually all of its ore was controlled by ownership arrangements. In the case of the other ore merchants, considerable quantities of their production were controlled either through ownership arrangements or long-term contracts with the major steel companies. As a consequence, it appears, on the basis of their reports to the Commission that the spot market for iron ore has virtually passed out of existence.

Sales by the ore merchants in 1949 have been classified as sales on long-term contract and spot sales. Total shipments by Cleveland-Cliffs amounted to 7 million tons of iron ore in 1949.[40] Of this amount,

[37] Although sharing with steel companies in the ownership of some of the mining companies for which it acts as managing agent, Pickands Mather has no significant interests in steel companies. To the Commission's inquiry concerning ownership of securities or possession of other interests in companies producing iron and steel, Pickands Mather replied. "Mather Iron Co., all the common stock of which is owned by Pickands Mather & Co., owns 15,000 shares common stock of the Youngstown Sheet & Tube Co., representing less than 1 percent of the outstanding voting stock. None of the partners of Pickands Mather & Co. are members of the board of directors of the Youngstown Sheet & Tube Co." But cf. p. 73, note 18, for some account of the complex of relationships in which are involved Pickands Mather, Mather Iron, Interlake Iron, Dalton Ore, Interlake Steamship, Youngstown, and Olga Coal.

[38] These shipments were as follows:

Steel company	*Gross tons*
Bethlehem Steel Corp	5,179,000
Youngstown Sheet & Tube Co	3,664,000
Republic Steel Corp	373,000
United States Steel Corp	820,000
Inland Steel Co	315,000
National Steel Corp	269,000
Total	10,620,000

[39] Shipments to users other than the big steel companies were as follows:

Company	*Gross tons*
Steel Co. of Canada, Ltd	890,000
International Harvester Co	186,000
Pittsburgh Steel Co	255,000
Pittsburgh Coke & Chemical Co	[a] 103,000
Four non-producers of steel (including Dalton Ore Co., Mather Iron Co., Shenango Furnace Co., and American Radiator & Standard Sanitary Corp.) [b]	1,839,000
Total	3,273,000

[a] From Pickands Mining Co. (cf. p. 75).

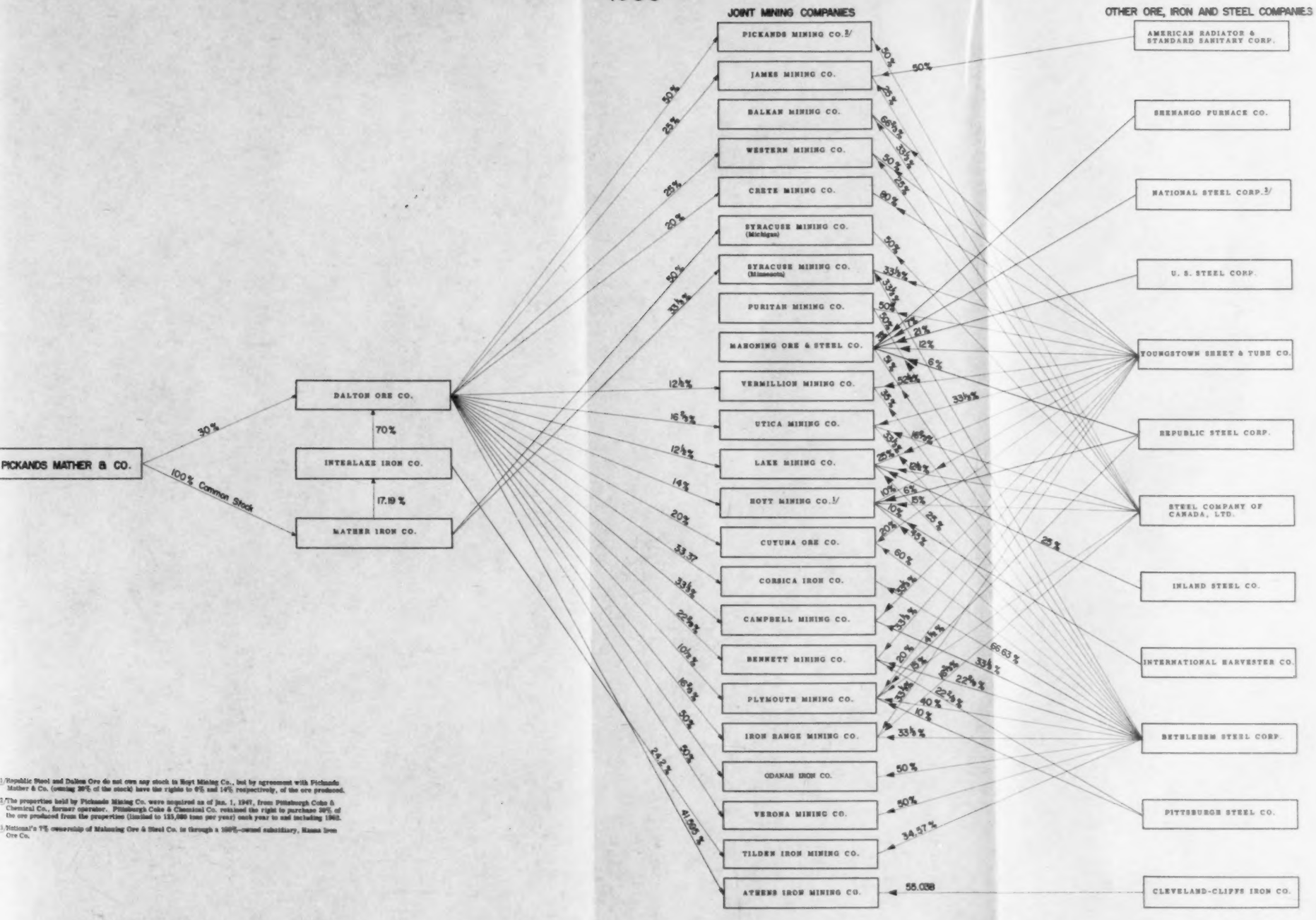
[b] Shipments to these companies were not broken down and can only be shown as a total. Mather Iron, controlled by Pickands Mather, is the largest single stockholder in Interlake Iron Corp., whose majority-owned subsidiary, Dalton Ore, also a Pickands Mather affiliate, is Interlake's principal source of ore (cf. p. 73, note 18). Presumably, therefore, the bulk of the ore making up these shipments went to Interlake for its blast-furnace operations, in which 1.9 million gross tons were consumed in 1948 (Interlake Iron Corp., 1948 Annual Report).

[40] Shipments of ore in 1948 by Cleveland-Cliffs, according to its report to the Commission, totaled 8.5 million tons. Approximately 1.7 million tons went to the large steel companies as a result of their ownership interests in Cleveland-Cliffs' companies. These shipments were as follows:

Steel company	*Gross tons*
Bethlehem Steel Corp	692,000
Inland Steel Co	390,000
Jones & Laughlin Steel Corp	194,000
National Steel Corp	176,000
Wheeling Steel Corp	249,000
Total	1,701,000

CHART XVI.

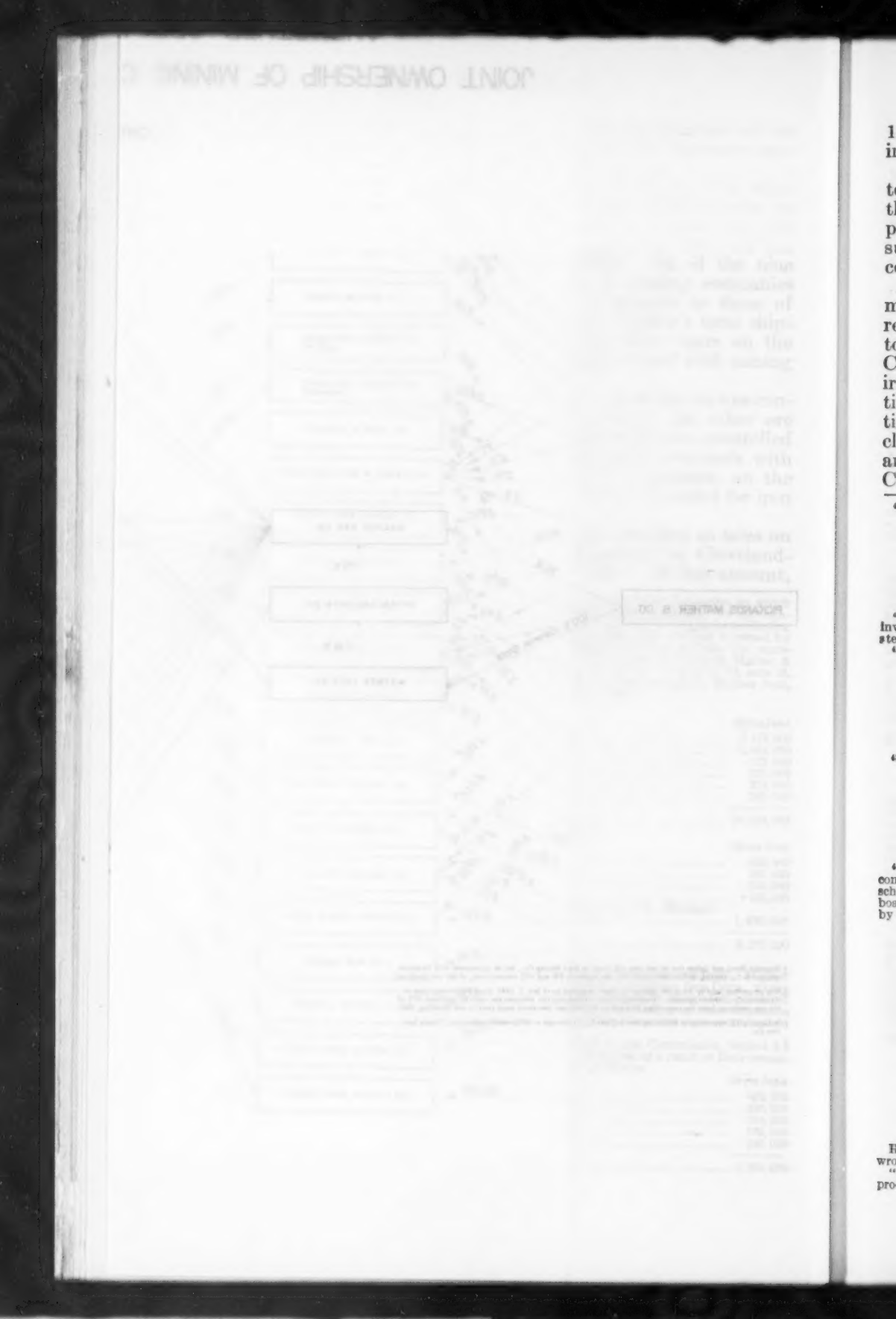
JOINT OWNERSHIP OF MINING COMPANIES BY PICKANDS MATHER & CO. AND OTHER ORE, IRON AND STEEL COMPANIES 1950



1/ Republic Steel and Dalton Ore do not own any stock in Hoyt Mining Co., but by agreement with Pickands Mather & Co. (owning 20% of the stock) have the rights to 6% and 14% respectively, of the ore produced.

2/ The properties held by Pickands Mining Co. were acquired as of Jan. 1, 1947, from Pittsburgh Coke & Chemical Co., former operator. Pittsburgh Coke & Chemical Co. retained the right to purchase 20% of the ore produced from the properties (limited to 125,000 tons per year) each year to and including 1962.

3/ National's 7% ownership of Mahoning Ore & Steel Co. is through a 100%-owned subsidiary, Hanna Iron Ore Co.



1.3 million tons went to five large steel companies on the basis of their investment interests in Cleveland-Cliffs' companies [41] (see chart XVII).

Contract sales to nine customers accounted for another 5.4 million tons. Among these nine were five of the largest steel companies, three of which have investment interests in Cleveland-Cliffs' companies.[42] As a result, only 1.1 million tons sold on contract were supplied to the four customers other than the nine largest steel companies.[43]

Adding all of the ore shipped as the result of ownership ties, approximately 1.4 million tons are accounted for. Another 5.3 million tons represent contract sales. Included in this latter figure are 214,000 tons, which were shipments to Algoma Steel Corp. and Steel Co. of Canada, Ltd., out of Cleveland-Cliffs' total exports of 462,000 tons of iron ore to Canada in 1949. Total shipments arising out of ownership ties and contractual arrangements amount to 6.7 million tons. Deduction of another 248,000 tons for Canadian exports which are not included in contractual sales, leaves about 50,000 tons. This latter amount apparently represents the entire spot sales of Cleveland-Cliffs Iron Co. in the domestic market in 1949.[44]

[41] Shipments in 1949 were as follows: [a]

Steel company	*Gross tons*
Bethlehem Steel Corp	549,000
Inland Steel Co	326,000
Jones & Laughlin Steel Corp	145,000
National Steel Corp	137,000
Wheeling Steel Corp	187,000
Total	1,344,000

[a] In addition, 147,000 tons of iron ore were supplied Pittsburgh Steel Co. in 1949 arising out of its 16-percent investment interest in Mesaba-Cliffs. Total ore, then, shipped by Cleveland-Cliffs in 1949 arising out of steel companies' ownership interests in its mining operations amounted to 1.5 million tons.

[42] Shipments to these big steel companies were reported as follows:

Steel company	*Gross tons*
Bethlehem Steel Corp	382,000
Jones & Laughlin Steel Corp	1,227,000
Republic Steel Corp	2,209,000
Wheeling Steel Corp	249,000
Youngstown Sheet & Tube Co	166,000
Total	4,233,000

[43] These shipments were as follows:

Steel company	*Gross tons*
Algoma Steel Corp	[a] 205,000
International Harvester Co	523,000
Portsmouth Steel Corp	394,000
Steel Co. of Canada, Ltd	9,000
Total	1,131,000

[a] These constituted shipments to Canada.

[44] Each of the reporting producers of ore was asked whether it owned securities or had other interests in companies producing iron and steel; and if the answer was in the affirmative it was asked to "submit a schedule of all such companies, stating in each case the nature of that interest, including membership on boards of directors, and the kinds, amounts, and percentages of outstanding stock and other securities held by the reporting company." Cleveland-Cliffs Iron Co. submitted the following schedule:

Company	Kind of stock	Number of shares (June 30, 1950)	Percent of outstanding stock	Membership on boards of Cleveland-Cliffs Iron Co. and of company indicated
Inland Steel Co	Common	283,500	5.79	E. E. Brown.
Jones & Laughlin Steel Corp	do	77,959	3.00	E. B. Greene.
Do	5 percent cumulative preferred A.	4,081	1.39	Do.
Republic Steel Corp	Common	364,614	6.19	A. C. Brown.
Wheeling Steel Corp	do	62,080	5.45	W. R. Burwell.
Youngstown Sheet & Tube Co	do	96,500	5.76	None.

Regarding ownership "in whole or in part by any company producing iron and steel," Cleveland-Cliffs wrote:

"The records of stock ownership of The Cleveland-Cliffs Iron Company do not disclose that any company producing iron and steel is a stockholder of the company. However, other records of the company indicate

The case of M. A. Hanna Co. was similar to that of Cleveland-Cliffs. In 1949 Hanna shipped a total of 10.8 million tons.[45]

Of this amount, about 8.9 million tons came from its own production and 1.9 million tons was purchased from others.[46] Approximately 5.1 million tons out of its own production of 8.9 million tons represented "captive" ore in the sense that its distribution was dictated by investment interests held by other companies [47] (see chart XVIII). Four companies affiliated in various degrees with Hanna, Hanna Ore Mining Co., Butler Bros., Philbin Mining Co., and Ozark Ore Co., reported contract sales amounting to 2.1 million tons.[48] No spot sales were reported by any of these companies.[49] One Hanna subsidiary, Hanna Coal & Ore Corp., furnished a combined report of contract and spot market sales. Its total shipments amounted to 3.5 million tons,[50] of which 1.8 million tons were obtained from its own mines and the remaining 1.7 million tons from other sources. It is of note that,

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that Republic Steel Corporation owns common shares of the company, but do not disclose the number of such common shares or the percentage of such stock ownership. Company records also disclose that Portsmouth Steel Corp., formerly a producer of iron and steel, which became a holding company in 1950, owned beneficially as of March 15, 1950, 235,714 shares of the company's common stock or slightly more than 10 percent of the common stock of the company. Mr. C. S. Eaton, Chairman of the Board and President, of Portsmouth Steel Corporation, is a director of the Cleveland-Cliffs Iron Company."

[45] In 1948 Hanna's total shipments amounted to 10.6 million tons. Of this amount, approximately million tons represented shipments resulting from ownership interests held by the major steel companies. In this connection it should be noted that National Steel Corp., an affiliate of M. A. Hanna Co., alone accounted for 3.6 million tons out of the total shipments of 5 million tons, thus leaving only 1.4 million tons for the other steel companies with investment interests in the Hanna mining companies.

Shipments to these steel companies were as follows:

Steel company	*Gross tons*
Armco Steel Corp	309,000
Inland Steel Co	305,000
Bethlehem Steel Corp	43,000
National Steel Corp. (Hanna affiliate)	3,601,000
Wheeling Steel Corp	734,000
Total	4,993,000

Figures on shipments supplied by Hanna were not segregated so as to disclose the amounts of ore shipped to the steel companies on the basis of their ownership interests. To arrive at these figures, an examination was made of the various companies' percentage interests in the individual mining companies, and the amount of ore to which they were entitled on the basis of these interests was then assigned. Any additional tonnage supplied them was regarded as open-market sales.

[46] Of the total shipments, approximately 350,000 tons were exported to Canada. In addition, Richmond Iron exported 26,000 tons of specialty ores to Canada.

[47] Such shipments were as follows:

Company	*Gross tons*
Armco Steel Corp	443,000
Bethlehem Steel Corp	182,000
Butler Bros. (Hanna affiliate)	380,000
Hanna Coal & Ore Corp. (Hanna subsidiary)	146,000
Inland Steel Co	258,000
National Steel Corp. (Hanna affiliate)	3,141,000
Wheeling Steel Corp	626,000
Total	5,176

[48] To fulfill its contractual commitments, one company, Butler Bros. ,purchased 256,000 tons.

[49] Total contract sales were as follows:

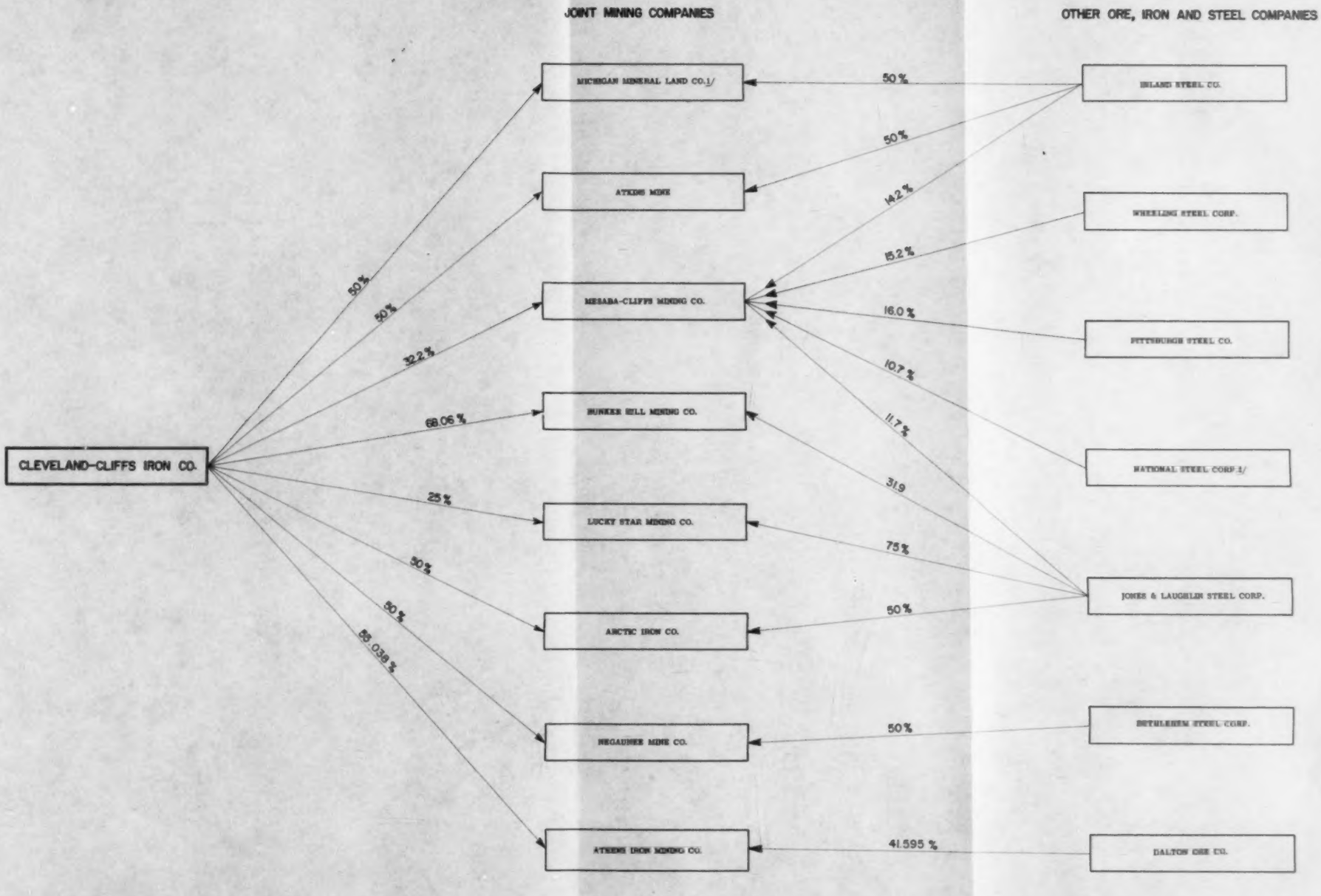
Company	*Gross tons*
Bethlehem Steel Corp	428,000
Hanna Coal & Ore Corp. (Hanna subsidiary)	346,000
Inland Steel Co	378,000
International Harvester Co	16,000
Koppers Co., Inc	142,000
Pickands Mather & Co	346,000
Utica Mining Co.[a]	464,000
Total	2,120

[a] Jointly owned by Dalton, Bethlehem, Youngstown, and Steel Co. of Canada, Ltd.

[50] Includes manganiferous ores.

CHART XVII.

JOINT OWNERSHIP OF MINING COMPANIES BY CLEVELAND-CLIFFS IRON CO. AND OTHER ORE, IRON AND STEEL COMPANIES 1950

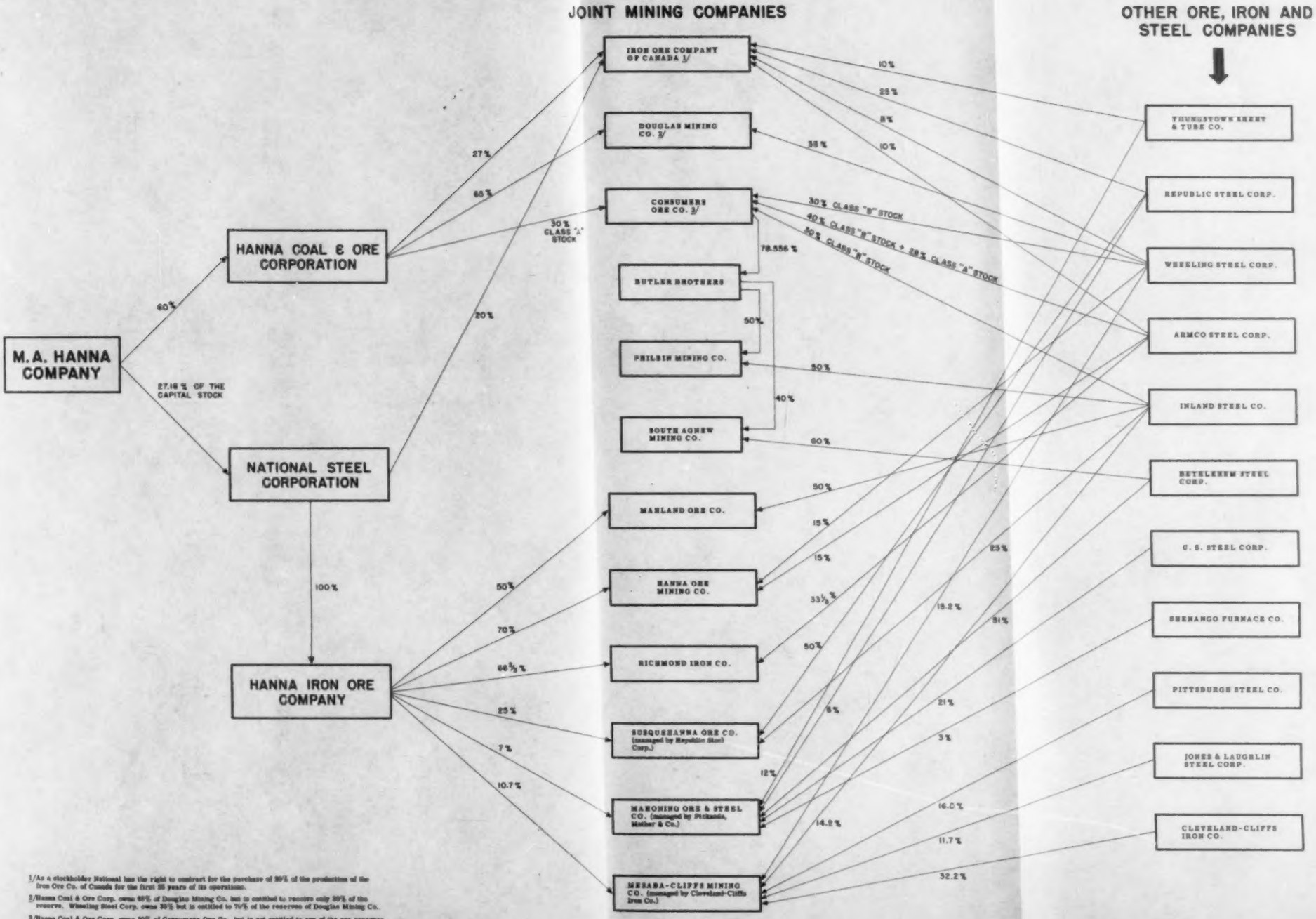


24167 O - 52 (Face p. 80) No. 1

1/Moody's 1950 p. 2782
2/Through Hanna Iron Ore Co.

CHART XVIII

JOINT OWNERSHIP OF MINING COMPANIES BY M. A. HANNA COMPANY AND OTHER ORE, IRON AND STEEL COMPANIES 1950



1/ As a stockholder National has the right to contract for the purchase of 30% of the production of the Iron Ore Co. of Canada for the first 35 years of its operations.

2/ Hanna Coal & Ore Corp. owns 69% of Douglas Mining Co. but is entitled to receive only 35% of the reserve. Wheeling Steel Corp. owns 30% but is entitled to 70% of the reserves of Douglas Mining Co.

3/ Hanna Coal & Ore Corp. owns 30% of Consumers Ore Co., but is not entitled to any of the ore reserves controlled by Consumers Ore Co. through its subsidiary, Butler Brothers.

CHART XVIII

JOINT OWNERSHIP OF MINING AND OTHER ORE

1950

M. A. HANNA COMPANY

NATIONAL STEEL COMPANIE

JOINT MINING COMPANIES

HANNA COAL & ORE CORPORATION

M. A. HANNA COMPANY

NATIONAL STEEL CORPORATION

HANNA IRON ORE COMPANY

of the total volume of 3.5 million tons, approximately 1.2 million tons constituted shipments to four of the nine largest steel companies.[51]

In summary, the Hanna group shipped a total of 10.8 million tons of iron ore to all users in 1949. Of this amount, 8.9 million tons came from its own companies, and 1.9 million tons were purchased from others. Approximately half of the total tonnage constituted "captive" ore, in the sense that its movement was dictated by investment interests held by other companies. However, of the 5.1 million tons thus involved, approximately 3.1 million tons went to National Steel, an affiliate of M. A. Hanna Co., and another half-million tons went to two other affiliated companies. This left about 1.5 million tons for four steel companies—Wheeling, Armco, Inland, and Bethlehem. The remaining 5.7 million tons represented open-market sales, including the 350,000 tons exported to Canada. Of the 2.1 million tons sold by four Hanna-related companies, Hanna Ore Mining Co., Butler Bros., Philbin Mining Co., and Ozark Ore Co., all were on contract.[52] The remaining tonnage was marketed by Hanna Coal & Ore Corp. However, these shipments, amounting to 3.5 million tons, were not segregated in terms of contract and spot sales.

The smallest of the ore houses is Oglebay, Norton & Co.[53] In 1949 production by this company amounted to only 1.34 million tons.[54] Total shipments for that year amounted to 1.28 million tons. Wheeling and Armco, with stock investments in Castile Mining Co., received from that company 168,000 tons and 140,000 tons, respectively.[55]

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[51] Shipments by Hanna Coal & Ore Corp. for 1949—both contract and spot—were as follows:

Company	*Gross tons*
Alan Wood Steel Co	14,000
Algoma Steel Corp.*	676,000
American Radiator & Standard Sanitary Corp	18,000
Canadian Furnace, Ltd	61,000
Cleveland-Cliffs Iron Co	150,000
Colorado Fuel & Iron Corp	18,000
Eastern Gas & Fuel Associates	190,000
Ford Motor Co	319,000
General Motors Corp	75,000
Globe Iron Co	19,000
Inland Steel Co	297,000
International Harvester Co	43,000
Jackson Iron & Steel Co	15,000
Koppers Co., Inc	285,000
Oliver Iron Mining Co. (United States Steel subsidiary)	207,000
Pittsburgh Coke & Chemical Co	257,000
Pittsburgh Steel Co	142,000
Republic Steel Corp	410,000
Wheeling Steel Corp	345,000
Total	3,541,000

*Cf. M. A. Hanna Co., annual report for 1950: "During the year * * * we * * * purchased an interest in the Algoma Steel Corporation, one of the leading producers in Canada with which we have been closely associated for a number of years."

[52] This excludes shipments to ownership interests, although the ore was sold under contract.

[53] Oglesbay, Norton reported to the Commission that it did not own securities or have other interests in companies producing iron and steel, and that it was not owned in whole or in part by any company producing iron and steel.

[54] Oglesbay, Norton reported that in 1948 it shipped 1.5 million tons—the amount of its production. Wheeling, with a 37½-percent interest in Castile Mining Co. received 226,000 tons. Armco, with a 25-percent interest in the same company, got 206,000 tons. It should be noted, however, that Wheeling reported that Castile is not a "mutual" company; that all sales are made on contract to Wheeling, Armco, and others.

[55] Although Wheeling reported that Castile Mining Co. makes all sales on contract, the shipments to Wheeling and Armco were not reported as such by Oglebay, Norton. Apparently they were regarded as shipments based on ownership interests. Contract sales, as reported by Oglebay, Norton were as follows:

Company	*Gross tons*
Armco Steel Corp	600,000
Bethlehem Steel Corp	163,000
Steel Co. of Canada, Ltd	*75,000
Total	838,000

* This constituted Oglebay, Norton's total shipment to Canada.

The 308,000 tons shipped to Wheeling and Armco and the 838,000 tons of ore sold on contract, totaled 1.1 million tons. The remaining 140,000 tons apparently constituted spot sales by Oglebay, Norton.

United States Steel is the only steel company which markets substantial quantities of iron ore. For this reason any discussion of the marketing activities of the major ore merchants would be incomplete without a brief discussion of the open-market sales of the country's largest steel company. In 1949 the steel company sold 3.5 million tons on the open market.[56] Of this, 2.1 million tons were sold on contract.[57] It is of interest that the largest quantity went to Sharon Steel Corp.[58] The second-largest amount went to Armco. Substantial quantities also went to Pickands Mather and to a subsidiary of Jones & Laughlin.

Spot sales in 1949 by United States Steel amounted to 1.4 million tons. Thus, of all the sellers of ore, the country's largest steel company was the only one which sold substantial amounts in the spot market. However, approximately 1,000,000 tons out of the total of 1.4 million tons of spot sales went to Republic, Wheeling, and Youngstown Sheet & Tube, all numbered among the nine largest steel companies, and to two ore merchants, Hanna and Pickands Mather. The only other purchaser in quantity was the Ford Motor Co.[59]

In brief, then, the ore merchants offer little hope of providing iron ore to smaller users or of assuring a vigorously competitive market for ore. Approximately half of the total production of the ore merchants goes annually to the nine big steel companies under existing ownership arrangements. A small quantity moves under similar ownership arrangements by other users of iron ore. Almost all of the balance is tied up in long-term contracts—mainly by the nine largest steel companies. The spot market, so far as sales by the ore merchants are concerned, is virtually nonexistent.

[56] In 1948 United States Steel sold 4.9 million tons out of the total of 33.9 million tons produced by Oliver Iron Mining Co. in the Lake Superior region. No breakdown of these sales is available for 1948.

[57] Contract sales reported by United States Steel were as follows:

Company	Gross tons
Armco Steel Corp	546,000
Inter-State Iron Co. (Jones & Laughlin Steel Corp.)	264,000
Pickands Mather & Co	459,000
Sharon Steel Corp	775,000
Shenango Furnace Co	91,000
Total	2,136,000

[58] The circumstances under which Sharon obtained its long-term contract for ore have been related on p. 67, Note 94.

[59] Spot sales were reported as follows:

Company	Gross tons
Allis-Chalmers Manufacturing Co	(a)
American Radiator & Standard Sanitary Corp	43,000
Ford Motor Co	179,000
Globe Iron Co	2,000
M. A. Hanna Co	274,000
W. S. Moore Co	10,000
Newport Steel Corp	52,000
Pacific Isle Mining Co	70,000
Pickands Mather & Co	136,000
Pittsburgh Coke & Chemical Co	7,000
Republic Steel Corp	299,000
Wheeling Steel Corp	34,000
Youngstown Sheet & Tube Co	252,000
Total	1,358,000

[a] 11 tons.

PART IV

IRON-ORE RESERVES AND THE FUTURE OF COMPETITION

Thus far in this report, attention has been centered on actual production and consumption of ore in recent years. This historical analysis has provided the necessary background information for an evaluation of the probable competitive effects resulting from the shift in the future sources of supply. It is with this question of the future that this part of the report is concerned.

Obviously, competitive superiority or inferiority in regard to iron ore is merely one of the numerous factors which make up the total competitive position of a steel company. Compensations for weakness in iron-ore resources may occur at other points in the company's operations; for example, in the greater modernization of equipment, in a more efficient management, in the use of the latest improvements in steel-making technology, in more economical corporate organization.

Nevertheless, among the factors affecting competitive potentialities in the steel industry, the size and quality of ore reserves is unquestionably one of major importance. The change in the ore situation which gives rise to the possible changes in competitive positions stems, of course, from the impending exhaustion of rich deposits in the United States and the consequent search for new supplies. In recent years the steel companies have searched abroad for iron ore; and their success in these ventures has greatly altered the prospective ore supply. In addition, there is the possibility of making commercial use of low-grade ores, such as taconites, which exist widely over the United States. These new developments must be included in any assessment of the companies' iron-ore positions for the future.

ESTIMATES OF RESERVES AND TAX CONSIDERATIONS

It should be noted, in advance of any discussion of future supplies, that estimates of reserves are a compound of precise measurements, less precise measurements, and plain guesswork.[1] Reflecting these differences in knowledge, the United States Department of the Interior has grouped reserves into three classes: "measured," "indicated," and

[1] Reserves are variously calculated for individual ore bodies, for mines, for districts, for States, by ownership, as particular reasons may dictate. The information available for some is much more complete and reliable than that available for others. For an individual ore body, information may be so complete and reliable that reserves can be accurately calculated. Information is usually better for deposits where there are operating mines than for those which are undeveloped. Both the quantity and quality of information about particular ore bodies are constantly changing, as new surveys are made and development and exploitation proceed. As an estimate is broadened from single mines or deposits, or mines of single ownership, or of similar geological characteristics, and comes to embrace districts or regions in which there are many ownerships and several types of deposits involved, the information available becomes progressively less complete and reliable. Much is known of the geological factors determining the character of ore bodies in the major producing areas; and, as a result, an estimate of the reserves within these areas, so far as relevant geological data afford guidance, can be made with a fair degree of reliability. On the other hand, geological knowledge concerning many districts is still incomplete; hence, it is impossible to make a comprehensive or accurate appraisal of the ore resources of these districts.

"inferred." [2] For obvious reasons, the steel industry has confined its search for ore to those ore bodies which can be most immediately and advantageously exploited. In consequence, the reserves of the Lake Superior district have been more fully explored and developed than other reserves; and the information concerning them is more complete and reliable than for those of any other district. The system of taxation of iron-ore reserves employed by the Lake Superior States—Minnesota, Michigan, and Wisconsin—also is responsible for the fact that a greater volume of information on the reserves of this district is readily available.[3]

The system of taxation tends to an understatement of actual reserves, since the properties that are blocked out through drilling and other development work are assessed at a higher valuation than reserves in undeveloped properties. The tendency then is to block out or prove only enough ore to assure adequate forward development of ore bodies. Partly as a result of the tax policy, the annual statistics on ore reserves compiled by the State tax commissions have not shown decreases proportionate to the amount of ore taken out of the ground. As of May 1, 1930, for example, the iron-ore reserves of Minnesota were reported to be 1,235 million gross tons; and as of May 1, 1949, 960 million gross tons. a decline on paper of only 275 million gross tons. However, actual shipments of ore from this area during this period amounted to approximately 828 million tons. The reserves of Michigan and Wisconsin, similarly, declined on paper by only 15.6 million tons during the same period, though approximately 214 million tons were shipped from the Michigan-Wisconsin ranges from 1930 to 1949.

This tendency to understatement of reserves becomes even more pronounced when the basis for comparison is broadened. Net reductions in the reserve tonnages of the Lake Superior region from 1920–49

[1] These classifications are defined as follows:

"Measured reserves are those for which tonnage is compared from dimensions revealed in outcrops, trenches, workings, and drill holes and for which the grade is computed from the results of detailed sampling. The sites for inspection, sampling, and measurement are spaced so closely and the geologic character is so well defined that size, shape, and mineral content are well established. The computed tonnage and grade are judged to be accurate within limits which are stated, and no such limit is judged to be different from the computed tonnage or grade by more than 20 percent.

"Indicated reserves are those for which tonnage and grade are computed partly from specific measurements, samples, or production data and partly from projection for a reasonable distance on geologic evidence. The sites available for inspection, measurement, and sampling are too widely or otherwise inappropriately spaced to permit the mineral bodies to be outlined completely or the grade established throughout.

"Inferred reserves are those for which quantitative estimates are based largely on broad knowledge of the geologic character of the deposit and for which there are few, if any, samples or measurements. The estimates are based on an assumed continuity or repetition, of which there is geologic evidence; this evidence may include comparison with deposits of similar type. Bodies that are completely concealed may be included if there is specific geologic evidence of their presence. Estimates of inferred reserves should include a statement of the special limits within which the inferred material may lie." (The Mineral Position of the United States, report prepared by the staffs of the Bureau of Mines and the Geological Survey, U. S. Department of the Interior, appendix, pp. 165-310, and index to Investigation of Natural Resources, hearings before a subcommittee of the Committee on Public Lands, U. S. Senate, 80th Cong., 1st sess. (1947) p. 185.)

[3] The Minnesota Tax Commission in 1907 evolved a plan for placing an ad valorem value on iron ore in the ground and taxing it by the ton. The plan takes into consideration the difference in value between developed and undeveloped properties as well as variations in mining costs between individual active mines. A detailed description of this plan can be found in Stanley committee hearings, vol. 5, pp. 3455-3459.

The work of the Tax Commission during the years immediately following the adoption of the new plan established the values that were followed with only relatively minor modifications thereafter. No important effort was made again by the Commission to make a present worth valuation of mineral deposits, although during the twenties the number of classes of ore properties used as assessment bases was increased, and a special schedule provided for taconite lands. This modification of the plan has been very influential in promoting the development and mining of State-owned low-grade ores, the leasing of taconite lands, and the resulting taconite research work.. (Cf. Warren A. Roberts, State Taxation of Metallic Deposits, p. 339.)

totaled 421 million gross tons, while actual shipments from the region for the same period amounted to over 1.5 billion gross tons.[4]

Although there has been only a gradual decline in the total regional reserve tonnage due to the discovery of ores through more intensive exploration, the decline in the higher grade and more cheaply mined open-pit ore has been relatively rapid. The total Mesabi Range ore reserves, for example, which are mostly open-pit, direct-shipping grade ore, decreased approximately 27 percent between the years 1924 and 1947, while the total assessed value of the mining properties declined 58 percent. The average assessed valuation per ton of Mesabi Range ore dropped from $0.213 in 1924 to $0.121 in 1947.[5] With assessed valuation being largely a function of the quality of ore, it appears, therefore, that the low-cost open-pit ore is rapidly disappearing.

QUALITATIVE DIFFERENCES IN ORE RESERVES

Of great importance in evaluating the steel companies' competitive positions in the future is the quality of the reserves held. From an economic standpoint, iron ore may be classified as commercial ore and potential ore. The former is ore which may be considered usable under present economic and technological conditions; the latter is ore that requires such treatment that it is not yet regarded as commercially feasible to exploit. Commercial ore in turn may be classified into two general types: direct-shipping and concentrating-grade ore. The latter must be subjected to chemical or physical treatment before it is ready for blast-furnace use. Obviously, material which can be mined and shipped without treatment is decidedly superior from a commercial standpoint because of savings in cost.

The variations in cost between direct-shipping and concentrating-grade ore are substantial. In a study of iron-ore technology and output per man published in 1940 by the Work Projects Administration, it was shown that for the years 1923 through 1937 the production of usable ore per man-hour averaged 2.572 tons for direct-shipping ore,

[4] The following table shows in greater detail the net reduction in the estimated reserves of the Lake Superior district from 1920 to 1949:

NET REDUCTION IN THE ESTIMATED RESERVES INCLUDING STOCKPILES OF THE LAKE SUPERIOR REGION FROM 1920–49

[In 1,000 gross tons]

Date	Estimated reserves	Shipments	Net decrease in estimated reserves
1920	1,540,767		
1921–30	1,400,378	506,692	−140,389
1931–40	1,367,243	336,730	−33,135
1941–45	1,186,053	417,437	−181,190
1946	1,144,141	59,588	−41,912
1947	1,153,342	67,981	+8,201
1948	1,136,450	83,485	−16,892
1949	1,119,792	69,229	−16,658
Total		1,541,142	−420,975

Source: Mining Directory of Minnesota, vol. LIII, No. 23, May 1, 1950, pp. 220–222

[5] Department of Taxation, State of Minnesota, Report to the Governor and the Legislature for the Twenty-first Biennium, 1947–48, vol. 1, pp. 43–44.

and 1.352 tons where concentration was necessary.[6] This was due primarily to the larger amount of ore required to be mined to produce a given quantity of usable ore.[7]

Similar cost savings are derived from open-pit as against underground operations. Where the overlying glacial drift is thin, the initial work merely involves the removal of the overburden; and power shovels then load the ore directly into trucks or railroad cars. Underground mines, in contrast, require developmental work in the sinking of shafts and construction of haulage tunnels and other workings to block out and remove the ore. The time and expense involved in underground mining make it difficult to expand or contract operations rapidly. The situation is quite different for open-pit mining. Curtailment or shut-down involves essentially the stoppage of shoveling operations; and the stand-by expenses are relatively low.[8]

Available cost data show substantial differences in ore-production costs. The State of Minnesota reported for 1948 that costs of strip operations in its area averaged approximately $0.47 per ton as against $2.50 for underground mines.[9] In the case of Michigan no cost data were available for open-pit mines because of their relatively small

[6] Work Projects Administration national research project in cooperation with U. S. Department of the Interior, Bureau of Mines, report No. E-13 (June 1940), Technology, Employment and Output per Man in Iron Mining, p. 228, table A-9.

[7] A wide variety of methods is used for producing concentrates, the simplest process being the washing of sand and other impurities out of loose ore. Besides washing, treatment methods may include one or more of the following: Crushing, sizing, jigging, heavy-media separation, tabling, abrasive grinding, magnetic roasting, magnetic concentration, flotation, and others. The more complicated and elaborate the methods, the higher, naturally, is the per ton cost of the concentrate. The most complicated type of treatment is that being developed and used for beneficiating taconites. (Taconite material is defined in the Minnesota tax laws as ore-bearing rock which is not merchantable as iron ore in its natural state, and which cannot be made merchantable by simple methods of beneficiation involving only crushing, screening, washing, jigging, drying or any combination thereof.)

[8] This flexibility of open-pit mining is of great strategic value during times of military crisis. During the period from 1938 to 1942, for instance, it was possible to increase production from the Mesabi Range, which contains for the most part open-pit ore, from 13 million tons to 70 million tons. This could hardly have been accomplished had operations on this range generally required the expenditure of time and energy connected with underground mining. Increasing open-pit mine production is a relatively simple matter of increasing the number of shovels and the manpower. In 1938, for example, 5,000 men produced 13 million tons of ore from the Mesabi pits, and in 1942 11,000 men produced 70 million tons. With the exhaustion of the open-pit mines on the Mesabi Range, this flexibility in operations will be lost because no other area in this country produces similar quantities of open-pit ore.

[9] In 1948 approximately 61 million tons of ore were mined from open-pit operations and almost 4 million tons from underground operations in the State of Minnesota. Thus, slightly more than 94 percent of the ore mined in Minnesota was from open-pit operations. It will be noted from the table below that direct costs, labor, and supplies, were over five times as great for underground mines as they were for open-pit mines in Minnesota.

Comparative costs of open-pit and underground ore in Minnesota and Michigan, 1948

	Open pit	Underground
Minnesota:		
Total gross tons mined	61,075,597	3,938,109
Cost of mining—Average costs per gross ton:		
Labor	$0.219	$1.697
Supplies	.251	.808
Total labor and supplies	$0.470	2.505
Michigan:		
Total gross tons mined	(a)	13,055,356
Cost of mining—Average costs per gross ton:		
Labor		$1.8290
Supplies		.7641
Total labor and supplies		2.5931

[a] Few open-pit mines.

Sources: Mining Directory of Minnesota, 1950, and Department of Conservation, State of Michigan, General Statistics Covering Costs and Production of Michigan Iron Mines, 1948.

number in that State; but costs in underground mines averaged in the neighborhood of $2.59 per ton.[10]

Another factor of importance is the cost of delivering the ore from the mines to the blast furnaces. This cost is influenced by a number of considerations, such as ownership of transport facilities, the distance the ore must be hauled, the mode of hauling, the commercial carrier rates, the terminal facilities that are involved, the ownership of such facilities, and similar matters. In the future shift of the steel industry to new sources of supply, particularly those outside of the United States, changes in cost of transportation are likely to create profound competitive repercussions in the industry.

DOMESTIC RESERVES

According to an estimate prepared by the United States Bureau of Mines, "measured" reserves of the United States, as of 1950, amounted to 1,380 million tons. Almost all of this ore was centered in the Lake Superior region, comprising the States of Minnesota, Michigan, and Wisconsin. Though immense tonnages of the best ore have already been taken from this area, the region still contains the finest deposits in the country. Since these reserves largely represent direct-shipping ore which can be obtained from open-pit operations, they also constitute the lowest-cost ore available in the United States.

The Minnesota Mining Directory, 1950, places the 1949 "measured" reserves of the Lake Superior district at 1,120 million tons. The nine largest steel companies of the country reported to the Commission ownership of reserves in this district aggregating 944 million tons, which would represent 84 percent of the total regional reserves.[11] In addition, the four major ore merchants reported approximately 132 million tons,[12] leaving other producers of ore in the district a total of only 44 million tons of reserves. If these universe totals are correct, the nine lar est steel producers and the four major ore merchants account for 96 percent of the "measured" reserves of the Lake Superior district.[13] It is thus unlikely that the smaller users of iron ore can lay claim to as much as 5 percent of the Lake Superior ore.

Information on the reserve holdings of these smaller users is very incomplete.[14] In the Lake Superior district several of these smaller users share ownership in a small number of mining companies managed by Pickands Mather, one of the major operating agents. In addition, a number of the small steel companies and merchant blast furnace operators purchase small quantities of ore under contract from the principal ore houses and United States Steel Corp.[15]

[10] Direct costs for the Michigan mines were only slightly higher than Minnesota underground mines, although the average depth of the Michigan mines is more than double that of Minnesota underground mines. There are many factors which operate to create wide variations in costs between operations in different underground mines and between mines in different ranges, i. e., depths of shafts, hardness of rock, structure of the ore deposit, length of haulageways, presence of water, timbering problems, and vein formations.

[11] This figure includes reserves based on investment interests in mining companies managed by the ore houses. Cf. table 2 for the total reserve holdings of the reporting companies.

[12] Held for their own account. Cf. appendix tables A-4, A-5, A-5 (a), A-6, and A-7 for the reserves of the individual ore merchants.

[13] Most of the ore owned by the four ore houses is mortgaged in short- or long-term contracts to the nine steel producers. Hence, the steel companies' actual control over regional ore resources surpasses even their extensive ownership of reserves.

[14] The Commission sent questionnaires on production to five of the major steel companies and four ore houses, and on consumption to nine of the major steel companies.

[15] In the other districts, northeastern, southern, and western, several of the companies have, quantitatively, substantial reserves. However, the reserves are generally low-quality deposits which can be exploited only by the more costly underground mining methods and which require some form of concentration before a suitable blast furnace product is obtained.

TABLE 2.—*Total Lake Superior reserves of the reporting companies, as of Jan. 1, 1949*

[In 1,000 gross tons]

	Total reserves	Direct-shipping		Concentrating	
		Open-pit	Underground	Open-pit	Underground
Ore houses:					
M. A. Hanna	24,289	3,427	13,650	6,124	1,088
Butler Bros.[1]	10,211	3,736	1,349	4,016	1,110
Cleveland-Cliffs	69,338	13,264	38,799	17,275	----------
Oglebay, Norton	6,627	----------	6,627	----------	----------
Pickands Mather[2]	[3] 21,478	3,295	[3] 15,432	1,351	1,400
Total	131,943	23,722	75,857	28,766	3,598
Steel producers:					
United States Steel	585,678	404,127	149,365	24,627	7,559
Bethlehem Steel	65,323	21,224	41,889	1,172	1,038
Republic Steel	13,762	3,866	8,029	1,251	616
Youngstown Sheet & Tube	46,419	13,450	25,494	4,442	3,033
Jones & Laughlin	56,049	9,303	31,917	13,452	1,377
National Steel	91,138	8,368	42,402	29,135	11,233
Inland Steel	49,746	6,312	36,455	5,779	1,200
Armco Steel	14,240	2,593	4,037	5,721	1,889
Wheeling Steel	21,894	3,467	7,967	7,466	2,994
Total	944,249	472,710	347,555	93,045	30,939
Grand total	1,076,192	496,432	423,412	121,811	34,537

[1] The reserves of Butler Bros. were reported through M. A. Hanna Co., although Hanna Coal & Ore Corp., a subsidiary of M. A. Hanna Co., does not have a controlling interest in Butler Bros. and does not report as managing agent. However, several of the officers of Butler Bros. are also officials of M. A. Hanna Co. or its various affiliates.

[2] The reserves of Dalton Ore Co., Mather Iron Co., and American Radiator & Standard Sanitary Corp. through their ownership in mining properties managed by Pickands Mather & Co. have been left to the account of Pickands Mather & Co. since it is impossible to allocate the reserves in proportion to their respective stock ownerships.

[3] Includes 1,365,000 tons of direct-shipping (presumably underground) reserves allocated to Dalton Ore Co. on the basis of Dalton's 41.6 percent ownership in Athens Iron Mining Co., managed by Cleveland-Cliffs.

Approximately 920 million tons of the Lake Superior reserves reported by the nine largest steel companies and the four major ore merchants were reported as direct-shipping ore. Somewhat more than half of this tonnage can be mined in open pits. Similarly, over 75 percent of the 156 million tons of concentrating-grade ores controlled by the reporting companies can also be mined by open-pit methods.

Although, as contrasted with "measured" reserves, estimates of "indicated" and "inferred" reserves are highly speculative, the Commission was interested in obtaining the reporting companies' estimates.[16] In the Lake Superior district the companies reported that "indicated" and "inferred" tonnages would increase their total reserves by 447 million tons, a 37-percent increase. Direct-shipping ores accounted for 362 million tons of this total and concentrating grades for 85 million tons.[17]

In contrast with these figures [18] are the recently revised estimates of the Bureau of Mines, which place the "indicated" and "inferred" reserves in the State of Minnesota alone at 1,581 million tons, of which 79 percent, 1,247 million tons, were listed as concentrates.[19]

[16] Cf. definitions of "measured," "indicated," and "inferred" reserves, p. 84, note 2.

[17] The "indicated" and "inferred" estimates of the reporting companies in the other three districts amounted to only 85 million tons.

[18] It should be noted that these estimates of "indicated" and "inferred" reserves of companies and totals are not comparable, due to differences in estimating techniques of the various companies (cf. pp. 83-87).

[19] This revised estimate did not include the remainder of the Lake Superior district (letter from the U. S. Bureau of Mines to the Federal Trade Commission, dated May 24, 1951)

Should tonnages as large as these eventually be proven, the utilization of these concentrates would require extraordinary capital outlays to produce a suitable blast furnace material. In view of the fact that the reserves of wash ores, those requiring simple beneficiation, are being rapidly exhausted, concentrating ores will, in the future, require more elaborate beneficiation methods. These methods, however, require the construction of highly complicated and expensive facilities for concentration and agglomeration. The size of the capital investment required for this type of undertaking prevents any but the companies with the largest financial resources from venturing into this field.

The statistics on "measured" ore reserves for the other districts of the country are much less reliable than those for the Lake Superior district.[20] The United States Bureau of Mines and the United States Geological Survey, in their estimate of reserves as of January 1950,[21] reported no "measured" reserves for the southeastern district, although they presented a total of 1,062 million tons of "measured" and "indicated" reserves for this region, the bulk of which are located in the State of Alabama.[22] The two reporting steel producers who own ore in Alabama, however, reported a total of 545 million tons of "measured" reserves alone. There is no way of reconciling the data. From all indications, however, the percentage of control by these two major steel companies over the usable ore of this district is high.

The principal deposits in the northeastern district are located in New York, Pennsylvania, and New Jersey. For the most part, the ore from these deposits has to be concentrated; and many of the deposits necessitate deep mining. Government subsidies during World War II greatly furthered the development of the northeastern ore bodies. In this district the reporting companies estimated, as of January 1949, "measured" ore reserves of 97 million tons, while the Bureau of Mines' estimate shows 202 million tons of "measured" reserves in this region. Since the Bureau of Mines estimate is more than double the reserves owned by the reporting companies, it is probable that the estimate includes ore deposits which would involve high mining costs if these deposits were to be exploited.

The most important deposits in the western district are located in Utah.[23] The companies reporting to the Commission stated that they held over 51.1 million tons of reserves in this district. Approximately 41.4 million tons were located in Utah, and the bulk of this ore constituted direct-shipping grades derivable from open-pit operations. The universe total arrived at by the Bureau of Mines shows no "measured" tonnages in the State of Utah, although "measured" and "indicated" reserves are said to total 100 million tons.

This district, like the southeastern and northeastern districts, has supplied only small portions of the total annual ore production of the country. In 1948 the Lake Superior district furnished 82 percent of the total usable ore produced in the United States, the southeastern, 9 percent, and the northeastern and western districts the residual, about equally divided. The companies reporting to the Commission accounted for 90 percent of the 1948 production in the Lake Superior

[20] Cf. discussion, pp. 83-85.
[21] The U. S. Bureau of Mines and the U. S. Geological Survey did not publish an estimate of reserves as of January 1, 1949, the date of the estimates of reserves reported to the Commission.
[22] In addition to Alabama, the southeastern district includes Georgia, Virginia, Kentucky, North Carolina, Tennessee, and West Virginia.
[23] Other States are California, Missouri, Nevada, Texas, Washington, and Wyoming.

district, 89 percent in the northeastern district, 64 percent in the southeastern district, and 41 percent in the western region. In the 3 years surveyed, the companies reporting to the Commission accounted for 85–87 percent of the total United States production of usable ore, a proportion which shows clearly the dominant position of these companies in the exploitation of domestic iron ore resources.

FOREIGN HOLDINGS AND TACONITES

With the rapid exhaustion of the high-grade low-cost domestic ores, the steel industry is faced with the necessity of obtaining high-grade ores from foreign sources or developing the lower-grade domestic ores called taconites. The extent of the development in either of the two possible directions will, of course, depend upon costs which cannot be definitely determined until production is under way.

The interests of American companies in foreign ore have become extensive. In the last few years leases have been taken on substantial reserves discovered in Canada and Venezuela; and one company is now operating in Liberia. Though the supplies from these new sources will be great, most of the properties are currently only in the process of development, and substantial shipments of ore will not take place for some years. Explorations are continuing, and the amount of proven ore that will actually be available from these properties is uncertain. However, a striking fact in connection with all of these foreign holdings is that a handful of the large companies have exclusive control.

Though imports have constituted a relatively minor contribution to the total ore consumption of American steel companies, their importance has been increasing. In 1946 and 1947 imports were approximately 3 percent of domestic production. In 1948, when domestic production reached 101 million gross tons, 6 million tons were imported, or nearly 6 percent of domestic production. Ore from Chile, Canada, and Sweden accounted for three-quarters of the total imports. In 1949 production in the United States was 85 million gross tons and imports totaled 7.5 million—almost 9 percent of domestic production, and a record high. Little of the imported ores was used in the great Midwest industrial areas, primarily because of the impossibility of entering the Great Lakes without transshipment. Even in the near future most of the imported ores will probably be consumed in facilities located near the eastern seaboard and on the Gulf.

Of all foreign ore holdings the most important to the United States from a strategic standpoint are the Canadian deposits. Exploration and plans for the exploitation of the Quebec-Labrador deposits are being promoted. Transportation costs will be relatively high, because of the necessity of building a 360-mile railroad from the properties to the St. Lawrence River. Another important Canadian ore deposit being developed is located in the Steep Rock Lake area in Ontario. This is on the Canadian National Railroad, 140 miles from the Lake Superior ore-loading docks at Port Arthur, Ontario. Hence the ore is easily accessible by water to steel plants in this country.

Three companies are exploring and developing properties in Venezuela, which contain enormous reserves of high-grade iron ore. The ore is to be shipped to eastern seaports and to the Birmingham area.

CHART XIX

Locations and Distances 1/ of Foreign Sources of Iron Ore

1/ In statute miles.

Source: M. A. Hanna Company, "New Sources of Iron Ore for the American Steel Industry," May 1, 1950, p. 5.

CHART XIX

Locations and Distances from Washington to Principal Ports of the World

One company has been receiving Venezuelan ore since March 1951. Export of ores from the Bomi Hills region in Liberia also began in 1951.

Brazil is estimated to have the largest reserves of high-grade iron ore in the Western Hemisphere, but their exploitation is subject to two limitations: (*a*) they are located more than 300 miles from the sea and in mountainous terrain; and (*b*) "the Brazilian mining code and Brazilian taxation are discouraging to foreign capital." [24]

The extent to which foreign ores will be utilized by United States steel producers in the immediate future will depend upon a number of factors. One of the most important considerations in the economics of iron and steel production is the question of transportation costs.[25]

Whatever the extent to which Bethlehem Steel Corp. was moved by desire for Pennsylvania Steel's facilities at Sparrows Point, Md., when it acquired their owner in 1916, it was certainly not unaware of the low cost of water transportation; and there can be no doubt that the steady expansion at Sparrows Point, and in particular the extensive additions and improvements made there since Bethlehem began development of its Venezuelan holdings, proceeded with full regard to the possibility of economic utilization of foreign ores.[26] Similar considerations appear to have influenced the decision of United States Steel to locate its new eastern steel-making facilities on the Delaware River, near Morrisville, Pa., where ore will be received from the Venezuelan properties now being developed.[27]

The major factors which must be taken into consideration in determining transportation costs, in addition to the size of the vessel, are: the total daily operating costs, including capital costs of the vessel; the return trip, whether loaded or in ballast; toll charges, if any; transshipment, and shipment by rail, if necessary. The iron content of the ore is also a determining factor. A richer grade of ore obviously permits a longer haul than a lower grade at the same cost per unit of iron content; on the other hand, much less ore of a 65-percent grade than of a 50-percent grade has to be hauled to provide a given quantity of metallic content.

The distance from Puerto Hierro, Venezuela, to Baltimore is 2,200 miles,[28] and to Mobile 2,400 miles. It is apparent that Venezuelan ore will be cheaper at seaboard ports than if delivered by rail to steel plants located inland. Benjamin F. Fairless, president of United

[24] "Under the mining code, all ore deposits are the property of the Brazilian Government. The deposits may be developed only by Brazilian companies, in which, under special decrees, foreign capital may participate. There is no possibility of getting the degree of control which American steel corporations regard as essential" (Marvin Barloon, "Steel: The Great Retreat," Harper's Magazine, August 1947, p. 151).

[25] Chart XIX shows the location of foreign sources of ore and their distances from ports of entry.

[26] Cf. Fortune's comments on the Pennsylvania Steel acquisition: "* * * in 1916 Schwab acquired one of the most important properties now a part of Bethlehem. * * * Pennsylvania Steel Co. * * * boasted a plant at Steelton, ore in Cuba, a majority interest in the Cornwall (near Harrisburg) ore banks, and most notable of all, a tidewater plant at Sparrows Point, Md. With Sparrows Point a part of the Bethlehem set-up, the ownership of Chilean ore, which could be shipped to Maryland, was converted from a potentiality into an asset" (op. cit., April 1941 ("Bethlehem Steel"), p. 139). Cf. also, Bethlehem Review, March 1950 (Annual Report to Employees for 1950), p. 12: "The expansion and growth of Sparrows Point began immediately after its acquisition by Bethlehem from the Pennsylvania Steel Co. in 1916. Today, it is the largest steel plant on tidewater, a factor of great importance in view of the increasing use of foreign iron ore in America." The quoted sentences are from an article, Annual Rated Steel Making Capacity at Sparrows Point To Be Increased by 740,000 Tons. Elsewhere mention was made of two open-hearth furnaces installed at Sparrows Point in 1947 and of Bethlehem's largest blast furnace having been been put in operation there in 1948.

[27] In the course of remarks at the ground-breaking ceremonies near Morrisville on March 1, 1951, Benjamin F. Fairless, president of United States Steel, said: "Today we are setting in motion two great streams of intercontinental trade that will greatly benefit both North and South America. Millions of tons of iron ore will come out of Venezuela to charge the furnaces we are building here. Many millions of dollars are already pouring out of the United States to develop the ore deposits in Venezuela" (United States Steel Quarterly, May 1951, pp. 8–9).

[28] All distances are given in statute miles.

States Steel Corp., testified before the House Subcommittee on Study of Monopoly Power that—

> if all cost factors remain as they are today, ores from Venezuela, according to our projected costs, will be cheaper laid down on the eastern seaboard of the United States, and to a certain portion inland, perhaps as far west as Pittsburgh, at least competitive, and in some cases with an advantage costwise over existing ore. * * * I do not, for example, have any idea that Venezuelan ores can be used in the Chicago district in competition with Labrador ores or Lake Superior ores.[29]

The United States Army Corps of Engineers estimated in 1951 that the cost of transportation of Venezuelan ore dockside (excludes rail haul in Venezuela) to Baltimore, and thence to Pittsburgh by rail, would be $4.80 per gross ton. (The then current rail freight rate on iron ore from Baltimore to Pittsburgh, a distance of 328 miles, was $2.51 per gross ton.) Transportation costs from Venezuela to Cleveland were estimated at $5.20 per gross ton, at the current rail freight rate of $2.91 per gross ton from Baltimore to Cleveland.[30]

Seven Islands, the St. Lawrence port for Quebec-Labrador ore, is 1,550 miles from Baltimore. It is only 950 miles, via the St. Lawrence River and the Great Lakes, from Seven Islands to the port of Ashtabula, Ohio, one of the main ports for Lake Superior ore, while Duluth, a major port for shipping Mesabi ore, is 875 miles from the lower lake ports. However, the canal system on the St. Lawrence River, which can accommodate boats of only 14-foot draft, substantially limits the tonnage of ore that can move over this route.

The United States Army Corps of Engineers estimated the cost of transporting ore from Seven Islands over the existing waterway facilities to Ashtabula, thence to Pittsburgh by rail, at $5.65 per gross ton.[31] (The current rail freight rate on iron ore from Ashtabula to Pittsburgh, a distance of 126 miles, was $1.76 per gross ton.) The estimated cost from Seven Islands to Cleveland was given as $3.90 per gross ton.[32] The Corps of Engineers estimated that if the St. Lawrence seaway were built, the cost of shipping ore from Seven Islands via the seaway to Ashtabula, thence by rail to Pittsburgh, would (assuming no tolls) be $3.80 per gross ton. To Cleveland via the seaway, the cost would be $2.05 per gross ton.[33]

The cost of transporting Mesabi ore to Pittsburgh, as of the date of the estimates reported, was $4.385 per gross ton, with the costs broken down as follows: Mesabi to upper lake ports by rail, $1.05 per gross ton; to lower lake ports by freighter, $1.25; dock unloading charge, insurance, tax, etc., $0.325; and, Ashtabula to Pittsburgh by rail, $1.76.[34]

Republic Steel Corp. is shipping its Liberian ore from Monrovia to Baltimore, a distance of nearly 4,900 miles.[35]

Iron ore from the Steep Rock Lake area is easily accessible to steel plants in the Great Lakes region. But since the ore is shipped from Port Arthur on Lake Superior, the transportation costs in 1951 were slightly higher than from Lake Superior ports in the United States, inasmuch as the rail freight rate from Steep Rock to Port Arthur was

[29] Celler committee, hearings, serial No. 14, pt. 4A ("Steel"), p. 546.
[30] St. Lawrence seaway, hearings before the Committee on Public Works, House of Representatives, 82d Cong., 1st sess. (1951), (pt. I), p. 232.
[31] Loc. cit.
[32] Loc. cit.
[33] Loc. cit.
[34] Mining Directory of Minnesota, 1950, vol. LIII, No. 23, May 1, 1950, p. 240.
[35] No estimates of transportation costs are available for Liberian ore.

$1.45 per ton over the Canadian National Railway,[36] compared to $1.05 per ton from Mesabi to Duluth.

In 1949 over 350,000 tons of ore were imported from Brazil, mainly through the port of Baltimore, a distance of 5,500 miles from Rio de Janeiro. In the same year, over 2 million tons were imported from Sweden, mainly to Baltimore, a distance of 5,000 miles from Narvik, where most of the Swedish ore is transshipped to ocean carriers.

Thus the economic feasibility of utilizing foreign ores will be determined, not so much by the cost of shipping the ore to the United States, as by the point of consumption in this country. In addition, it is obvious that the price of the ore f. o. b. foreign port will also determine whether the ore will be competitive with ores from other sources.

The exploitation of the other great potential source of supply, taconites, presents even more serious problems. Technologically, taconites may be divided into two groups, depending upon the state of oxidation of the iron they contain. In the magnetic or unoxidized taconite, most of the iron present is in the form of magnetite. In the nonmagnetic or oxidized taconites, the iron occurs mostly as hematite or limonite. The magnetic taconites can be ground and the iron separated magnetically from the waste materials. To effect a comparable separation in the nonmagnetic type, the ore would have to be roasted to convert the iron minerals to magnetite, or some other method of separation would be required.[37] At the present stage of experimentation, the production of usable blast-furnace material from nonmagnetic or oxidized taconites is not commercially feasible because of high costs.

In either case, however, since the iron is finely disseminated and locked in the quartz, the rock must be crushed and ground extremely fine to prepare it for a concentration process. Practically all the methods now being used or proposed for the solution of the taconite problem are along the lines of conventional ore beneficiation. Magnetic taconite is favored because of the possibility of magnetic separation. However, since the reserves of magnetic taconites are not nearly as large as those of the nonmagnetic taconites, a relatively inexpensive process to recover iron from the latter variety would have greater economic significance.[38]

It is certain that magnetic taconite can be mined economically only on a very large scale and only from very large ore bodies, since the requisite plant investment is high and the yield of concentrates is only 1 ton for every 3 tons of crude material mined. Plant units with a capacity of 2.5 million tons of concentrates annually would probably require minimum ore reserves of 150 million tons. Investment cost for producing taconite concentrates has been estimated at

[36] Business Week, April 28, 1951, p. 98.
[37] Mining Engineering, May 1950, p. 561.
[38] Prof. John W. Gruner, of the University of Minnesota, estimates that the Mesabi Range contains only 5.5 billion tons of probable magnetic taconite ore, equivalent to 1.8 billion tons of concentrates of 60–65 percent iron. According to Professor Gruner, magnetic taconite reserves account for only about one-sixth of the total volume of taconite, estimated at 27 billion tons. But this total is reduced to 5.5 billion because of the fact that much taconite ore lies under worthless rock layers which would have to be removed to quarry the magnetic ore. Cost of such rock removal would soon become prohibitive. For this reason open-pit mining would have to stop at about a 200-foot depth, not counting the thickness of the glacial overburden (Iron Age, January 6, 1949, pp. 230–231).

between $15 to $20 per annual ton. This figure does not include the daily operating cost.[39]

The eastern end of the Mesabi Range has large deposits of taconites which can be beneficiated by the relatively cheap magnetic separation process. The State of Minnesota has reduced taxes on taconite ores as a measure to encourage their beneficiation. Taconites in the State of Michigan are predominantly hematite. Although nonmagnetic hematite can be reduced to magnetite by heating and using reducing agents, the operation is costly.

UNITED STATES STEEL CORP.

Domestic reserves

Most of this company's domestic ore reserves are held through Oliver Iron Mining Co., operating in the Lake Superior district. Oliver's report to the Commission showed "measured" reserves in this district amounting to nearly 579 million tons for 1949.[40] In addition, Oliver held a 21-percent interest in Mahoning Ore & Steel Co., managed by Pickands Mather. This interest added another 6.7 million tons of Lake Superior ore to the reserves of United States Steel Corp.[41]

Of the total reserves of approximately 586 million tons held by Oliver, approximately 404 million were classified as direct-shipping ore which can be derived from open-pit operations.[42] Thus, when its holdings are compared with regional data listed in the Minnesota Mining Directory, 1950, approximately 80 percent of the total quantity of this low-cost ore in the Lake Superior district appears to be held by United States Steel Corp. Expressed in terms of the 1948 consumption of its furnaces utilizing Lake Superior ore, the company has sufficient reserves to last it another 17 years.[43] This does not take into consideration the possible substitution of foreign ores and taconites or any possible curtailment of sales to other than affiliated companies.

United States Steel's valuable reserves in the western district are located in the Iron Mountain and Desert Mount area of Utah. Columbia Iron Mining Co., the mining subsidiary in this district,

[39] All pilot plants beneficiating taconite have so far approached the problem in much the same way. The process begins with crushing and fine-grinding the ore to separate the iron from the siliceous material. Then come various physical separation procedures (or combinations of several), among which are mechanical, gravity, flotation, and magnetic methods. (Magnetic separation seems at this time to be receiving the most attention.) What is usable of the "powder" produced by the initial crushing and grinding must then be agglomerated in some manner—nodulizing, sintering, briquetting, or pelletizing—in order to obtain a lump suitable for blast-furnace charging. Only as a final agglomerated concentrate can the material derived from taconite be considered comparable with present high-grade ore. Obviously, the most desirable taconite used in the magnetic separation method should have two-thirds of its iron in the form of magnetite, since in this process the hematite is discarded with the waste in the tailing. In addition, it should be characterized by relatively coarse crystals which would require less fine grinding and make magnetic separation easier. The degree of fineness to which the ore must be ground and the magnetite content of the iron embedded in the taconite are the variables determining whether costs will approach a prohibitive figure or be modest enough to avoid a serious increase in finished steel prices (Engineering and Mining Journal, November 1950, p. 85).

[40] Benjamin F. Fairless, president of United States Steel, stated in his testimony before the House Subcommittee on Study of Monopoly Power in 1950 that his company owned about 51 percent of the commercial ore reserves in the Lake Superior district (Celler committee hearings, pt. 4A, ("Steel"), p. 538). This estimate agrees with the figures showing its share of reserves in the Lake Superior district which United States Steel submitted to the Commission.

[41] United States Steel also has an 11.89-percent interest in Montreal Mining Co., operating in the Lake Superior region. This interest did not seem to entitle United States Steel to a proportionate share in the mining company's reserves, since Oglebay, Norton, the managing agent, reported that it sells the entire production of the mining company under contract.

[42] Reserve tonnages presented here are for ore in the "measured" category. It should be understood, however, that not all of the mining company's vast properties have been fully explored. Oliver reported an additional 133 million tons of ore in "indicated" and "inferred" categories.

[43] Cf. appendix table A–1 for a graphic comparison of 1948 rates of production and reserves.

supplies the entire ore requirements of Geneva Steel Co., the local steel producing affiliate of the parent company. Columbia reported 41.4 million tons of "measured" reserves of open-pit, direct-shipping grade ore as of 1949.[44] To date, only the Iron Mountain portion of its regional reserves has been developed. The ore in this district is comparable in quality to the high-grade Lake Superior ore.

TABLE 3.—*Domestic reserves of United States Steel Corp. as of Jan. 1, 1949*

[In 1,000 gross tons]

Company and percent ownership	Total reserves	Direct-shipping		Concentrating.		Potential
		Open-pit	Underground	Open-pit	Underground	Measured, indicated, inferred
Oliver Iron Mining Co. (100 percent) Lake Superior district [1]	578,968	400,444	146,536	24,429	7,559	12,340,000
Mahoning Ore & Steel Co. (21 percent) Pickands Mather report	6,710	3,683	2,829	198		
Montreal Mining Co. (11.89 percent) [2] Oglebay, Norton report						
Total, Lake Superior	585,678	404,127	149,365	24,627	7,559	12,340,000
Tennessee Coal, Iron & Railroad Co. (100 percent) Alabama properties	507,500		507,500			
Columbia Iron Mining Co. (100 percent) Utah properties	41,410	41,410				

[1] Includes Mesabi, Vermilion, and Cuyuna Ranges in Minnesota, and Gogebic, Menominee, and Marquette Ranges in Michigan and Wisconsin.

[2] Montreal Mining Co., through Oglebay, Norton & Co., reported total reserves of 4,955,000 tons. It appears that Montreal Mining Co. is not a "mutual" company; hence, the reserves have been left to the account of Oglebay, Norton & Co., the managing agent, and not allocated to the owners on the basis of their ownership. It is presumed the ore is purchased under contract by United States Steel.

Tennessee Coal, Iron & Railroad Co., United States Steel's subsidiary in Alabama, supplies the bulk of its ore needs from underground deposits of direct-shipping grade ore it owns in the Birmingham district.[45] The company reported 507.5 million tons of "measured" reserves as of 1949. Less than a third of this tonnage was located in mines which were producing as of that date.

United States Steel has also been conducting research in the field of taconite exploitation. Oliver Iron Mining Co., operating in the Lake Superior district, reported that it held 12.3 billion tons of open-pit taconite ore reserves, the iron content assaying below 49 percent dry iron.[46] The company estimated that the minimum capacity of a one-unit treatment plant would be 2.5 million long tons of product yearly, with a provision for expansion in the number of units in a given plant. The investment required for a plant capacity of 10 million tons of agglomerated product annually was estimated at approximately $200 million, or about $20 per annual ton of installed capacity. Oliver stated that the minimum grade preferred would be a product containing 64 percent iron, although the probable grade may range from 60 to 66 percent iron. The extent of beneficiation at the mine against the costs of coke, limestone, and transportation at the blast furnace will dictate the probable grade.

[44] "Inferred" reserves amounted to another 31 million tons.

[45] To sweeten the low grade of the ore in this district, United States Steel imports high-grade ore from abroad. Like Republic and other steel producers in the southeastern district, it also buys some of the output of small producers of brown ore in the region.

[46] United States Steel reported all ore reserves assaying below 49 percent dry iron in the category of taconites.

The cost of the finished agglomerate, as was estimated by the company, would range from $5.50 to $6 per long ton at the beneficiation plant.[47] Initial disposal of tailings would be on wasteland provided for that purpose, although eventual disposition of the waste would be in exhausted taconite pits. The company estimated that the time required for completion of the project after approval would be 3 to 5 years, depending on the size of the plant.

Reviewing in its Annual Report for 1951 Oliver's "program to make iron ore available from taconite," United States Steel Corp. said:

> * * * Construction of the first pilot combination sintering and nodulizing plant on the Mesabi Range was completed in 1951 at Virginia, Minn. This plant has a capacity to produce about 500,000 tons of refined iron ore annually and will later take over the final stage of the taconite concentrating process. Construction of the corresponding experimental milling plant to remove the iron content from taconite rock was commenced during the year. These milling, sintering, and nodulizing units will complete the pilot stage of a development which is expected to lead to the construction in the future of a series of taconite plants of vastly larger total capacity.[48]

The second of the pilot taconite beneficiation plants mentioned in the report was that at Mountain Iron, Minn. The announcement that ground had been broken for this plant on May 17, 1951, was accompanied by the statement, "It is expected that the plant will be placed in operation during the summer of 1952." [49]

Full production of 500,000 tons of finished concentrates is hoped for by 1953. The plant will have a capacity for handling 2 million tons of crude ore annually.[50] The project will include, in addition to the plant, the development of a taconite mine to be equipped with rock drills, power shovels, and rail haulage with Diesel locomotives. Plans also call for construction of shops, offices, a water-supply system, power-distribution lines and substations, water-disposal dumps, and other related facilities.[51]

Foreign holdings

In recent years United States Steel, like other large steel companies, has been prospecting for ore outside the United States. It has captured the richest prize of any iron-ore prospector to date—the Cerro Bolivar deposits in Venezuela.[52] Extensive drilling operations began in the latter part of 1947, and by 1950 approximately 400 million tons of high-grade, open-pit ore were proven. It has been estimated that the reserves of high-grade iron ore in this area may be in excess of 1 billion tons. Extensive drilling has also taken place on Federal territory adjacent to Cerro Bolivar; and in this area about 40 million tons of ore have been proven, of equally high quality. Orinoco Mining Co. was organized in 1949 to develop and operate the Venezuela properties.

United States Steel Corp. reported to the Commission that plans for its Venezuelan properties—

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[47] Power requirements were estimated at 14,000 kilovolt-amperes demand per million tons of finished product annually; labor requirements at 240 men per day per million tons of finished product annually; and water requirements 200 gallons per long ton of crude taconite.

[48] Op. cit., p. 11.

[49] United States Steel Quarterly, May 1951, p. 14.

[50] Steel, May 21, 1951, pp. 49–50.

[51] Daily Metal Reporter, May 18, 1951, pp. 1, 12.

[52] The corporation obtained in 1946–47 leases on 74,130 acres in the Federal reserve zone and 21,250 acres in the territory outside the Federal zone. Concessions in the Federal reserve zone are for a duration of 40 years; for the areas outside, they are for a duration of 50 years, with an option of renewal for an additional 50 years.

are being formulated to develop these deposits, but it is difficult to estimate at this time, due to the many factors involved, when production and shipments to the U. S. A. can be expected. The important factors which affect the time when ore can be shipped include the availability of materials and equipment for construction and development, the conclusion of certain necessary agreements, and the effect of the season of the year on the work schedule.

The most complex problem faced by the company was the route to be used in bringing the ore out of the country. Plans reported to the Commission in May 1951 contemplated using the Orinoco River route, involving the construction of approximately 90 miles of railroad from Cerro Bolivar to a river terminal at the confluence of the Orinoco and Caroni Rivers, and "initially dredging the Orinoco River for a minimum of 24-foot draft during periods of low water." "Dock, plant and town sites [had] been selected and rights-of-way secured." [53]

Before the end of 1951, "Orinoco Mining Co. completed the engineering phases of its plans * * *. Negotiations with the Venezuelan Government were concluded with the signing of an agreement late in 1951 in connection with the creation and maintenance of a channel for oceangoing ships in the Macareo and Orinoco Rivers and with the signing of an agreement regarding Venezuelan customs early in 1952. Dredging contracts have been placed, as well as contracts for the construction of a dock, railroad tracks, loading and other facilities in Venezuela. It is expected that shipments of iron ore from this source will begin in 1954." [54]

The maximum tonnage to be shipped annually will depend upon a number of factors primarily related to the demand for ore and the economy of the operation. In view of the open-pit type of mining operation planned, additional mining and transportation facilities would enable the production to be expanded to as much as 15 million gross tons annually if the demand existed and conditions for producing and transporting that quantity of ore to the United States were favorable.

The company reported that it is expected that Venezuelan ore will be sold on the open market and by contract. Vessels of various capacities and drafts will be used for ocean transportation.[55] The points at which the ores will be delivered and utilized in competition with domestic ores will depend upon several factors, primarily upon the respective cost burdens involved.[56]

The company stated that it had no agreements with Bethlehem Steel Corp. on tonnages to be shipped from Venezuela, nor any arrangements for the sharing of dock terminal facilities or storage facilities with that corporation, although the dock terminal facilities of both companies on the Orinoco River are adjacent.

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[53] U. S. Steel Corp. Annual Report for 1950, p. 7.

[54] Idem, Annual Report for 1951, pp. 11–12.
In the fall of 1950 a trade source stated that Orinoco Mining Co. is expected to spend $120,000,000 in developing the Cerro Bolivar project. This would include the company's initial expense in dredging the river, construction of the railroad from the mine site to the river terminal, port construction, housing, and administration building (Steel, Oct. 23, 1950, p. 48). (Cf. also The Economist (London), June 28, 1952, Venezuela: An Economic Survey, p. 908).

[55] To supplement existing available ocean transport, a type of vessel is being considered for ore service with a length of 700 to 750 feet, a beam of about 100 feet, and draft (in salt water) of 35 feet. No decision has yet been made with respect to the ownership of such vessels as will be built to supplement existing capacities.

[56] Venezuelan ore may be imported into the United States through various ports, including Philadelphia, Morrisville, Baltimore, and Mobile. The amount to be imported through each port will vary with the aggregate shipments from Venezuela and the competitive conditions for iron ore in various parts in the United States.

Competitive position

On the domestic front, United States Steel's interests dominate in three of the four principal mining districts. In the Lake Superior district, the great source of iron ore in the past, United States Steel in 1949 owned 62 percent of the reserves reported by the nine largest steel producers.[57] In Alabama, in the southeastern district, its reserves were nearly 15 times larger than those of Republic, its only competitor among the reporting companies in this region. In Utah, in the western district, its reported deposits outstripped by far, both in size and quality, the ore-mining properties of any other company in that region. The only area in which United States Steel does not own commercial ore deposits is the northeastern district, but this district has been furnishing only a relatively small fraction of the country's ore production, and is noted for its high costs.[58]

In terms of the quality of the ores and their cost of mining, the competitive strength of United States Steel is accentuated. More than 85 percent of the open-pit, direct-shipping ore reserves held by the nine largest steel companies in the Lake Superior district, and virtually all such low-cost ore in the western district, the only other domestic region where it is found in quantity, is held by United States Steel. Such detailed data on mining costs for individual ore producers as are available are, unfortunately, incomplete and somewhat out of date. There are, however, some comparative figures for Minnesota which, with the caveat that they have been controverted by United States Steel, seem worth citing. Using data compiled from the occupation tax reports of the State of Minnesota, E. A. Wisco of the Butler Ore Co. prepared certain tabulations, based upon the reports in question,[59] purporting to show mining, transportation, and miscellaneous other costs, and also operating incomes per ton of ore mined in Minnesota during the years 1943, 1944, and 1945. These tabulations were originally introduced as evidence in a rate case,[60] but were subsequently offered as exhibits in support of testimony given by Wisco before the House Subcommittee on Study of Monopoly Power in 1950.[61]

The tabulations for 1945, the latest year for which data were presented, show that the average production cost of ore mined was $1.35 for Oliver Iron Mining Co., United States Steel's ore-mining subsidiary in the Lake Superior district. This cost was approximately $0.63 per ton lower than that of the ore accounted for by all other producers in the same area. An even more salient comparison is possible on the basis of Wisco's tabulations of operating incomes of

[57] United States Steel's control of reserves in this district is in sharp contrast with its share of blast furnace and steel-making capacity. In 1948 this company accounted for slightly over 50 percent of the blast-furnace capacity and output, and for slightly less than 50 percent of the steel-making capacity and output of the nine largest steel producers in the Great Lakes district. Its control over raw-material resources is substantially greater.

[58] In a letter to the Commission dated July 10, 1950, the company refers to direct and indirect interests held by the company in mineral-bearing lands in Cuba, New York State, and Ontario, Canada, which are undeveloped and have no present commercial value.

[59] Wisco testified before the House Subcommittee on Study of Monopoly Power (Celler committee hearings, serial No. 14, pt. 4A,("Steel"), p. 169): "The production costs have been adjusted from the occupational tax to include royalty tax, occupational tax payments, full ad valorem tax, and one other item * * *." This other item "was home office expense."

[60] I. C. C. No. 29502, *Butler Bros. v. Great Northern Railway Co. et al.* (submitted June 14, 1949, decided January 9, 1950). The State of Minnesota and various range municipalities in Minnesota were interveners supporting the complainant. The report of the Interstate Commerce Commission appears in Celler committee hearings, serial No. 14, pt. 4-B ("Steel exhibits"), exhibit 8-42, pp. 54-68.

[61] Cf. Celler committee hearings, serial No. 14, pt. 4-A ("Steel"), pp. 165-177, for Wisco's testimony. His tables appear in *ibid.*, pt. 4-B ("Steel exhibits"), as exhibits 8-15 to 8-41, pp. 15-53.

the most profitable mines in Minnesota during 1945. Eight of the twelve mines averaging an operating income in excess of $1 per ton mined in 1945 were wholly owned by Oliver Iron Mining Co., and one was owned partially by that company. The company's interests accounted for over 95 percent of the total production of these 12 mines in that year.[62]

On the foreign front, United States Steel also occupies a favorable position. The reserves in the Cerro Bolivar deposits in Venezuela constitute some of the highest grade ore found anywhere on the globe. After the construction of necessary facilities, the magnitude of ore shipments from these holdings will largely be determined by company policy..

Similarly, in the field of taconite beneficiation, the predominant position of United States Steel cannot easily be threatened. Here, for most companies, the enormous size of the investment required for research, pilot-plant operations, and the commercial exploitation of these low-grade ores is a serious problem. No ore consumer in the country appears to be in a better position than United States Steel to assume this financial burden. From the standpoint of size of taconite reserves, too, Oliver's 12.3 billion tons surpass those assembled under any other single ownership.

In terms of present plans for steel expansion, the company will have an important role. On the basis of certificates of necessity already issued, by 1953, United States Steel will have added 16.3 percent in steel furnace capacity and about 10 percent in blast furnace capacity to the facilities it owned in 1948.[63] Most of this capacity will be accounted for by the company's plants in the Great Lakes district.[64] There is no question that Oliver owns sufficient ore in the Lake Superior area and, because of the open-pit character of its mines, can expand production fast enough to continue supplying the steel-making subsidiaries of the parent company with large tonnages of low-cost ore for well over another decade.

But the company's diverse holdings give it the opportunity to exercise selectivity in production which no other steel company possesses. It has, in other words, a higher elasticity of substitution. It is not unreasonable to assume that United States Steel will make some effort to conserve its high-grade, low-cost domestic ore. It can, if it wishes, substitute underground direct-shipping ores; it can develop its production of concentrating grades; it may rely heavily on its foreign reserves, or even institute intensive work on taconites. All of these possibilities, of course, have limits imposed by technical

[62] It should be noted in connection with the use made of Wisco's testimony and exhibits, however, that in a communication, "Comments on the Testimony of Mr. Wisco Relating to the Iron Ore Situation," R. T. Elstad, president, Oliver Iron Mining Co., told the subcommittee that "an analysis of the data presented and consideration of its source will disclose that it is both unreliable and inaccurate." Elstad referred to "the inherent weaknesses of Mr. Wisco's figures," and said that "one of the principal factors invalidating the results of Wisco's work is his treatment of royalty and royalty tax and failure to consider acquisition cost and carrying charges and depletion." On the basis of a "discussion of the Wisco methods," Elstad asserted that Wisco's "calculations cannot result in a reliable comparison of operating results," and that "the only reliable conclusion which can be drawn from Mr. Wisco's calculations of 'operating income' is that his testimony is of no value in determining either the relative mining profits between operators or the relative value of the ore properties involved" (Celler Committee hearings, Serial No. 14, pt. 4A ("Steel"), pp. 177–179). Nothing was offered by United States Steel in the way of corrected figures or comparisons.

[63] Cf. appendix table A–8 for the 1948 blast furnace and steel-making capacities of the nine major steel companies.

[64] A plant now under construction at Morrisville, Pa., will have a steel furnace capacity of 1.8 and a blast furnace capacity of 1.2 million tons. These facilities as well as United States Steel's plants in the Pittsburgh-Youngstown area may eventually depend on imports from the company's Venezuelan ore properties. The mill at Morrisville was more than 55 percent physically completed in May 1952 (United States Steel Quarterly, May 1952, p. 1).

considerations; but they provide the country's largest steel company with unusual flexibility and a wide range of choice.[65]

Another possible way of conserving the company's high-grade Lake Superior reserves would be through the curtailment of open-market sales of ore. Although there had been, as early as January 1949, reports that Oliver's policy of selling ore on the open market would be discontinued,[66] Benjamin F. Fairless, president of United States Steel, in his testimony before the House Subcommittee on Study of Monopoly Power, in April 1950, disclaimed any such intention. Regarding sales to others, he said:

> I want to make it clear they are less because of our customers causing them to be less, not because of any change in our policy.

Oliver's diminishing sales to others during the years 1945–49 meant, according to Fairless, that its customers "got their ore from other sources."[67] But whatever the explanation, there was a progressive decline in the volume of Oliver's sales to competitors of United States Steel.[68]

An examination of Oliver's sales contract commitments reveals that, with the exception of two contracts, they are of relatively short duration.[69] Thus no major obstacles would appear to stand in the company's way if it decided to curtail further, or discontinue altogether, sales to outsiders.

The ability of United States Steel to withhold supplies of ore from the market is in itself a weapon of considerable consequence. An examination of Oliver's contracts shows that five of the steel company's major competitors, in addition to a number of smaller companies, are customers of Oliver. They are dependent upon this mining company's ore for a portion of their supplies. Whether exercised or not, this power to deprive competitors of ore is a potential weapon to bring recalcitrants into line and to keep them there. As shrinking reserves

[65] Cf. United States Steel Corp., Annual Report for 1949, p. 9: "The problem of an adequate supply of iron ore for the future is being approached by U. S. Steel on two fronts—the refining of ores of lower grade from the Lake Superior district and the development of extensive, newly discovered iron-ore deposits in Venezuela. It is obviously not prudent or in the national interest to exhaust unduly the remaining iron ore reserves of higher grade in the Lake Superior district. * * * U. S. Steel hopes to establish an iron ore program which will result in the minimum cost increase for iron ore as new sources of ore are developed, and, at the same time, will conserve the maximum amount of 'readily minable' domestic natural ore of higher grade for utilization in the future."

[66] Iron Age, January 6, 1949, p. 123.

[67] Celler committee hearings, Serial No. 14, pt. 4A ("Steel"), p. 562.

[68] A tabulation of Oliver's open market sales for the years 1945 to 1949, inclusive, shows that such sales not only declined in volume over this period but also constituted decreasing percentages of annual production figures in each successive year, at least from 1947 through 1949, years for which production data are available.

Comparison of annual volume of production and sales of ore, Oliver Iron Mining Co.

[In 1,000 gross tons]

Year	Production	Sales [a]	Sales as percentage of production	Sales [b]
			Percent	
1945	([c])			9,276
1946	([c])			7,400
1947	32,452	6,359	19.6	6,900
1948	33,890	4,844	14.3	5,700
1949	30,882	3,495	11.3	4,100

[a] Data furnished to F. T. C.
[b] Data furnished by B. F. Fairless to House committee.
[c] Not available.

[69] The agreements referred to here are with Sharon Steel Corp. and Youngstown Sheet & Tube Co.

and a steadily tightening ore market enhance the importance of Oliver ore, the strategic position of United States Steel in this regard will be strengthened.

BETHLEHEM STEEL CORP.

Domestic reserves

Bethlehem has no direct mining subsidiary operating in the Lake Superior district. Its interests in this area, evidenced largely by fractional stock ownership in a large number of mining companies, are administered by the four ore merchants.

TABLE 4.—*Reserves of Bethlehem Steel Corp. as of Jan. 1, 1949*

[In 1,000 gross tons]

Properties, managers, and ownership	Total reserves	Direct shipping		Concentrating	
		Open pit	Underground	Open pit	Underground
Minnesota properties (Pickands Mather report)	32,388	14,057	16,721	572	1,038
Michigan properties (Pickands Mather report)	10,357	456	9,901	----------	----------
South Agnew Mining Co. (60 percent) (Hanna report)	6,238	3,765	1,873	600	----------
The St. James Mining Co. (75 percent) [1] (Oglebay, Norton report)	2,946	2,946	----------	----------	----------
The Negaunee Mining Co. (50 percent) (Cleveland-Cliffs report)	[2] 13,394	----------	[2] 13,394	----------	----------
Total, Lake Superior	65,323	21,224	41,889	1,172	1,038
Bethlehem-Cuba Iron Mines Co. (100 percent), Pennsylvania properties	33,281	----------	----------	2,036	31,245

[1] In addition, commitment for deliveries to Bethlehem equal to 40 percent of the production of the South Agnew mine of South Agnew Mining Co. The reserves of 40 percent of the South Agnew mine amount to 2,558,000 tons.

[2] Presumed to be underground ores, since past production is reported as underground.

NOTE 1.—Bethlehem has a 45-percent ownership in Erie Mining Co. and affiliates, a taconite development managed by Pickands Mather. Erie Mining reported 539 million tons of potential ores in form of concentrates.

NOTE 2.—Bethlehem has 734,000 tons of direct-shipping open-pit and 111,000 tons of direct-shipping underground manganiferous ores allocated by Pickands Mather from mining companies in which Bethlehem has stock interest.

Pickands Mather is the managing agent for 17 mining companies in which Bethlehem has investment interests. As of 1949, Bethlehem was entitled to over 42.7 million tons of the reserves of these companies (see table No. 4). Approximately 32.4 million tons of the total were located in Minnesota, over half of which quantity was underground ore. The remaining 10.3 million tons in Michigan and Wisconsin were almost entirely underground properties. Since most of the ore in the Lake Superior area is of direct-shipping grade, the reserves managed by Pickands Mather for Bethlehem are of high quality.

Bethlehem also has a 50-percent interest in the Negaunee Mining Co., with underground properties located in the Lake Superior district which are managed by Cleveland-Cliffs. Bethlehem's share of this company's reserve tonnage was reported as 13.4 million tons. It has a 60-percent interest in South Agnew Mining Co., managed by Butler Bros., one of the Hanna affiliates. Its ore reserves in this company amounted to over 6.2 million tons. Some 60 percent of this ore is open-pit. Bethlehem held another 3 million tons of open-pit reserves through its 75-percent interest in the undeveloped properties

of St. James Mining Co. This property is managed by Oglebay, Norton.

Apart from these properties in the Lake Superior district, Bethlehem's only other domestic source of ore is its mines in the northeastern district. Bethlehem-Cuba Iron Mines Co., operating in Lebanon County, Pa., listed 33.3 million tons of concentrating-grade reserves in its report to the Commission. All but 2 million tons represented underground operations.[70]

Bethlehem is also concerned with the problems of taconite beneficiation. It has a 45-percent interest in Erie Mining Co., whose affiliates, Huron Land Co. and Ontario Iron Co., are owners of various taconite deposits in Minnesota.[71] Pickands Mather, managing agent for the venture, stated that the reserves of 539 million tons represented an estimate of the magnetic concentrates available from the taconite properties owned or leased by Erie Mining Co. and affiliates, and which may be developed by removal of surface strata.[72]

Erie Mining Co. has constructed and is operating a preliminary taconite plant near Aurora, Minn., with a maximum rated capacity of 200,000 tons of product per year. The company stated in June 1950, that the operation of the plant up to that date had been intermittent due to shut-downs for changes in equipment and flowsheets.

Pickands Mather reported that it was not possible to make any definite statements with regard to the economic size of a commercial treating plant and the investment required, but expressed the opinion that unquestionably the investment would be large and might be as much as $15 to $20 per ton of annual capacity. Experiments have indicated that a product of approximately 64 percent iron can be produced, and it was hoped that the cost of the product on a unit-of-iron basis would not exceed the cost of producing deep underground iron ore. If the decision is made to start construction of a commercial taconite treating plant, it is estimated that it will be 4 to 6 years before taconite concentrates will be produced.

In 1951, Erie shipped 70,000 tons of pellets, the largest quantity shipped to date. This progress, and test data accumulated by users of "these high-grade concentrates," [73] appear to have stimulated Erie to formulate plans for an impressive expansion of its operations. In its annual report for 1951, Interlake Iron Corp., whose subsidiary, Dalton Ore, has a 10-percent stock interest in Erie, indicated the scope of Erie's planning:

"* * * At the present time Erie has under consideration a large-scale taconite development in Minnesota, the ultimate cost of which is now estimated at approximately $300,000,000 and has recently

[70] Subsequent to its report to the Commission, a new ore deposit was discovered by Bethlehem at Morgantown, Pa. (a few miles south of Reading), where in August 1951, according to the Bethlehem Review for March 1952, "sinking of the main shaft was started at the Grace mine. The ore body, a magnetite formation similar to that at the Cornwall mine near Lebanon, Pa., lies at a depth of 1,500 to 3,000 ft., and the shaft sinking is therefore the major phase involved in preparing to work the deposit. A second shaft, for men and materials will," it was said, "be started later on. Work is also underway on a machine shop and warehouse and a main office building. A beneficiating plant providing for concentrating and pelletizing of the ore is being designed." It was considered "too early to estimate how much" the operation will yield; but the Morgantown property was mentioned among reserves characterized by E. G. Grace, chairman of Bethlehem's board of directors, as "important." "Ore from the mine can be delivered to the steel plant at Bethlehem, Pa., with a freight haul of only about fifty miles" (op. cit., pp. 1, 7, 17).

[71] Youngstown Sheet & Tube Co. with a 45-percent interest and Dalton Ore Co. with a 10-percent interest represent the remaining ownership interests.

[72] Extension of these reserves which can be made available by rock-stripping have not been included in the estimate. In addition, the reserves of nonmagnetic material will not be included until experimental work has proved that concentrates can be produced on an economic basis.

[73] Youngstown Sheet & Tube Co., Annual Report for 1951, p. 6.

applied to the Defense Production Administration for a certificate of necessity for this proposed project on a basis calling for eventual annual production of up to 10,500,000 tons of iron ore pellets. The program contemplates the construction of a large taconite plant on the Mesabi Range, a new community for the plant employees and their families, a large power plant, a railroad from the plant to Lake Superior, and docks and loading facilities at the harbor site.[74]

Foreign holdings

Of the nine major steel producers, Bethlehem has been the largest and most consistent importer of iron ore. In the past foreign ores have accounted for between one-fourth and one-third of its total ore supply (see table 5, "Sources of Iron Ore Supply for Bethlehem Steel Corp.").

Three factors account for the magnitude of Bethlehem's imports. First, although Bethlehem is the second largest steel producer in the United States, its domestic reserves are low. Second, since many of its properties require underground operations, they are relatively high cost. Third, the location of the Sparrows Point, Md., facilities on the Atlantic coast favors imported ore because of relatively low transportation costs; in 1948 foreign ores accounted for over 80 percent of the ore supplied to Sparrows Point.[75]

TABLE 5.—*Sources of iron ore supply for Bethlehem Steel Corp., 1939, 1947–49*

Sources of supply	1939		1947		1948		1949	
	Gross tons	Percent	Gross tons	Percent	Gross tons	Percent	Gross tons	Percent
DOMESTIC								
Minnesota	2,303,205	27.4	5,206,579	37.1	4,682,297	32.0	3,919,709	27.7
Michigan and Wisconsin	1,789,214	21.3	3,056,181	21.8	2,644,204	18.1	2,137,569	15.1
Total Lake Superior	4,092,419	48.7	8,262,760	58.8	7,326,501	50.1	6,057,278	42.8
Pennsylvania	1,432,462	17.0	1,700,763	12.1	2,120,946	14.5	2,239,212	15.8
New York	180,796	2.1	683,966	4.9	812,156	5.5	741,105	5.2
Other domestic	72,942	.09	61,392	.4	67,456	.5	62,762	.04
Total domestic	5,778,609	68.7	10,708,881	76.2	10,327,059	70.6	9,100,357	64.3
FOREIGN								
Company-owned:								
Cuba	273,027	3.2	97,233	.7	1,663	.01	493	----
Chile	1,591,745	18.9	1,709,079	12.2	2,572,206	17.6	2,632,994	18.6
Total company-owned	1,864,772	22.2	1,806,312	12.9	2,573,869	17.6	2,633,487	18.6
Other foreign	766,823	9.1	1,531,131	10.9	1,735,547	11.9	2,428,593	17.1
Total foreign	2,631,595	31.3	3,337,443	23.8	4,309,416	29.4	5,062,080	35.7
Total supply	8,410,204	100.0	14,046,324	100.0	14,636,475	100.0	14,162,437	100.0

Source: Federal Trade Commission questionnaires.

Iron Mines Co. of Venezuela, a Bethlehem subsidiary, reported to the Commission that it owns properties covering approximately 21,000 acres in Venezuela. The three properties—El Pao, Imperial, and Gutierrez—lie atop the so-called Iron Mountain, located about

[74] Op. cit. (Feb. 15, 1952), p. 5.

[75] Foreign ores accounted for 82 percent of the ore supplied to the Sparrows Point facilities in 1939, 69 percent in 1947, 82 percent in 1948, and 79 percent in 1949. In 1939 Bethlehem accounted for nearly all of United States iron-ore imports, and in 1947–49, for 68–70 percent.

150 miles from the seaboard.[76] In its report to the Commission Bethlehem stated that as of January 1, 1949, its "measured" reserves in the El Pao property amounted to 45 million gross tons.[77] The ore is hard hematite, free from impurities, and is estimated to have an average iron content of 63 percent in natural condition.

Bethlehem informed the Commission that shipments from the El Pao property to the United States were expected to begin early in 1951. It was estimated that 1 million gross tons would be shipped during the first year of operations, and that this figure would be increased to 2.5 or 3 million gross tons annually as facilities were completed. "On March 23, 1951, the ore carrier *Bethore* arrived at the Sparrows Point plant with the first cargo of iron ore from Bethlehem's El Pao mines in Venezuela. * * * Shipments, which were maintained on a regular schedule for the remainder of the year, totaled approximately 800,000 net tons. Practically all of this ore was used at the Sparrows Point plant. In addition, a considerable tonnage was stockpiled at the Palua River transfer station in Venezuela and at the ocean port, Puerto de Hierro." [78]

The company stated that the development work on the El Pao property began in 1941. A total of $40 million had been spent in developing the property by the end of 1949. The company estimated that another $14 million would be necessary to complete the facilities.[79] Mining operations on a limited scale were begun in August 1950.

The plans which had been matured for shipping and stockpiling the ore were thus described by Bethlehem in March 1951:

> From the mines at El Pao the ore is taken by rail 36 miles to Palua on the Orinoco River for storage or for loading into shallow draft vessels or barges for shipment down the river to the transfer station at Puerto de Hierro, a distance of about 230 miles. Here the ore is transferred to the stockpile for loading into specially designed ore carrying vessels for shipment to the United States. Vessels are loaded at the rate of 3,000 tons per hour. The storage yard at Palua has a capacity of approximately 800,000 tons and that at Puerto de Hierro, 1,250,000 tons.
>
> The river vessel *Punta Aramaya*, built at the Sparrows Point yard, has a carrying capacity per trip of approximately 8,500 tons and has just been put into operation. A sister ship, *Punta Morocoto*, will be completed this spring.[80]

The arrangements for shipping developed by Bethlehem are presumably the most economical for the amount of ore it intends to move. The entry of United States Steel Corp. into the same area

[76] "The El Pao property consists of mineral concessions (for a period of 90 years from the respective dates of the grants, 1926 and 1927, and renewable at the option of the holder upon the payment of a charge) * * *, covering in the aggregate 19,151 acres, in the State of Bolivar, Venezuela, about 35 miles south of the town of San Felix, which is located on the Orinoco River near the confluence of that river and the Caroni River. * * * The Imperial properties consist of mineral concessions (the duration of which is not limited by their terms) * * *, covering in the aggregate 1,482 acres, located in the State of Bolivar, Venezuela. The Gutierrez properties consist of mineral concessions (for a period of 90 years from the respective dates of the grants, 1926 and 1927, and renewable at the option of the holder upon payment of a charge) * * *, covering in the aggregate 617 acres, also located in said State of Bolivar." (Report to FTC.)

[77] "The Imperial and Gutierrez properties," Bethlehem wrote, "have not been explored sufficiently to determine the amount of the iron-ore reserves contained therein but, on the basis of preliminary surveys, it is estimated that at least 10 million gross tons of iron ore similar to El Pao iron ore is contained in these properties" (report to FTC). A recent report states that "El Pao is estimated to hold 70 million tons of mineral, the ore containing from 58 to 68 percent of iron," and that "neighboring deposits can be expected to supplement this * * *." (The Economist (London), June 28, 1952, p. 908). According to the Journal of Commerce (New York), Oct. 13, 1949, p. 20, geologists estimated Bethlehem's concessions to hold a minimum of 300 million tons of high-grade iron ore.

[78] Bethlehem Review, March 1952, p. 17.

[79] A breakdown of the total cost of all facilities is as follows: (1) 35 miles of railroad from the El Pao mines to the Orinoco River and port and storage facilities there, $15 million; (2) steamers, barges, tugs, and other equipment for use in transporting ore approximately 200 miles on the Orinoco River and the Gulf of Paria, $12½ million; (3) transfer station near Guiria, Venezuela, with facilities for the unloading of ore from river barges and steamers, for the storage of ore, and for the loading of ocean vessels, $14½ million; and (4) mining plant, including housing facilities, $12 million. The sum of $65 million has recently been mentioned as the estimated cost of Bethlehem's development program in Venezuela (The Economist (London), June 28, 1952, p. 908).

[80] Bethlehem Review, March 1951, p. 19.

with a much larger project could, however, have some influence upon Bethlehem's operations. Since the Venezuelan Government has agreed to the dredging of the Orinoco River by United States Steel Corp., as against the plan, once considered, of building a 274-mile railroad to Barcelona, it would be possible for Bethlehem to bring its 26,000-ton *Venore* carriers to the railroad dock at Palua, with a subsequent reduction of transportation costs for Bethlehem.[81]

Another Bethlehem subsidary, Bethlehem Chile Iron Mines Co., has two concessions in Chile. The El Tofo property, which is in production, covers 371 acres owned by the company, plus 99 adjacent acres leased from a French corporation. In 1941 the El Tofo mines were said to contain 45 million tons of ore with a 60-percent iron content. At the 1949 level of production of 2.5 million tons, the remaining reserves will be depleted about 1954. As of 1949 they were estimated to be in the neighborhood of 10.5 million gross tons of iron ore of 58 percent natural iron.[82]

A second concession, the El Romeral property, covers 716 acres and contains an estimated reserve of approximately 20 million gross tons of ore of 60 percent natural iron. As reported to the Federal Trade Commission, the development of the El Romeral property by Bethlehem began in 1950. It is expected that shipments of ore will commence in 1953 on the basis of an annual production of 1 million gross tons.

Bethlehem Chile Iron Mines Co. reported that it had a contract commitment to La Société des Hauts Fourneaux, Forges et Acièries du Chili, S. A., to furnish up to 100,000 gross tons annually for 5 years for use in the latter's Chilean facilities. In addition, it had an agreement with Compañia de Acero del Pacífico, S. A., to sell a maximum of 300,000 tons annually for consumption in Acero del Pacífico's Chilean facilities. Hence it appears that Bethlehem's shipments to the United States from its Chilean properties will be limited by the amount of ore which it will have to deliver to the two Chilean companies. Since total annual shipments from El Romeral are expected to be small—viz, 1 million tons—the ores from this property will be insufficient to replace the diminishing supplies from Bethlehem's older El Tofo concession.

Bethlehem also has had for many years an interest in Cuban ore. Bethlehem-Cuba Iron Mines Co. owns properties covering, in the aggregate, 167,853 acres located on the north coast of Cuba and in the Provinces of Oriente and Camaguey. The ore of commercial grades in these deposits has been exhausted and the mines abandoned. However, the properties contain approximately 1,650 million gross tons of mineral, classified as limonite, with an average iron content of 36 percent, but containing some impurities.

Although Cuba has large deposits of potentially usable iron ore, no method has as yet been discovered to make exploitation of these deposits commercially feasible. The deposits are lateritic iron containing nickel and chromium. If some economical method could be

[81] Bethlehem is said to find that the cheapest transportation by water can be achieved through the use of huge carriers of approximately 25,000 tons capacity (U. S. Department of Commerce, Bureau of Foreign and Domestic Commerce, Industry Report on Domestic Transportation, An Economic Appraisal of the St. Lawrence Seaway Project, p. 15).

[82] The ore is transported from the mine to the shipping port at Cruz Grande over a company-owned railroad, a distance of 14 miles. From Cruz Grande the ore is hauled to Sparrows Point, Md., by a fleet of 10 ore-carrying vessels having an annual carrying capacity of approximately 3 million gross tons.

devised to remove the chromium, it would be possible to recover a suitable ore for blast furnace use by agglomeration. Bethlehem reported to the Commission that research is being conducted for a practical method of utilizing the low-grade deposits, but there is no indication that it has been successful.

Since the submission of reports by the steel companies to the Commission, Bethlehem has become a participant in the ore development project in Steep Rock Lake, Canada. "Toward the end of 1950," Steep Rock Iron Mines, Ltd., "concluded * * * with a group headed by Pickands Mather & Co. and including the Steel Co. of Canada, Ltd., Bethlehem Steel Co., Interlake Iron Corp. and the Youngstown Sheet & Tube Co." an agreement to explore under an option to lease and develop an area adjoining the acreage (the C ore body) on which Inland Steel Co. obtained an option in 1949. The agreement, like that with Inland, provides "for intensive exploration over a short term, followed by immediate development on a royalty basis, on a scale consistent with reserves disclosed by exploration."[83] Together, Inland and the Pickands Mather group appear to have obtained options covering "the eastern third of the Steep Rock range."[84] Although the Pickands Mather portion of the range contained no proven ore body, several ore deposits were believed to exist there. Since the agreement with Steep Rock Iron Mines, Ltd., provided for "intensive exploration over a short term," reports that exploration and drilling were scheduled to start in the winter of 1951–52 were probably correct.

Competitive position

While United States Steel is in a position not only to meet its ore requirements from the production of its own mining interests but also to sell ore to other steel producers, Bethlehem is not self-sufficient. In 1948 the Nation's second-largest steel producer was able to depend upon wholly or partially owned mines for approximately two-thirds of its total requirements of ore for that year.

Among Bethlehem's domestic ore reserve holdings, its Lake Superior properties are first in importance. The company, unlike United States Steel, has no mining subsidiary in this district. Its interests in the area, evidenced mainly by fractional stock ownership in various mining companies, are administered by four different ore houses. On the basis of its ownership in these mining companies, Bethlehem holds 65.3 million tons of reserves. Open-pit direct-shipping ore represents slightly less than a third of this tonnage, or about one-twentieth of United States Steel's reserves of this type of ore in the same district.

Lake Superior ore is consumed at all five of Bethlehem's steelmaking plants,some as far east as Sparrows Point, Md. Except at the Lackawanna, N. Y., plant, use of this ore involves a relatively costly rail haul from the lower Lakes ports. Most of United States Steel's plants in the Great Lakes area are more favorably located with respect to shipments of ore from Lake Superior mines than are Bethlehem's plants.

Depletion of Bethlehem's low-cost reserves in the Lake Superior district is far advanced. At 1948 levels of production Bethlehem's

[83] Steep Rock Iron Mines, Ltd., Annual Report for 1950.

[84] Loc. cit. Business Week, April 28, 1951, pp. 94–95, reported Inland's C ore body to consist of 800 acres, and gave 1,000 acres as the area of the tract on which Pickands Mather and its associates had obtained their option. Cf. also Engineering and Mining Journal, March 1951, p. 130; Daily Metal Reporter, June 5, 1951, p. 9. For a discussion of the Steep Rock Lake ore deposits, cf. pt. IV, Inland Steel Co., pp. 123–127.

reserves of open-pit ore—of both direct-shipping and concentrating grades—will be exhausted by 1955. It is doubtful that production from underground mines, which amounted to little over 2 million tons in 1948,[85] could be expanded sufficiently within this period to offset the shrinking production from open pit reserves.

Some indication of the relatively high cost of mining underground ore of concentrating grade is the fact that to date relatively little of the Lake Superior ore of this type has been mined. The nearness of the Pennsylvania deposit to the consuming plants, however, should compensate to some extent, at least, for higher mining costs. The Lebanon County reserves may not approach exhaustion for another two decades in view of Bethlehem's modest annual receipts from this source and the comparatively limited expansibility of production.

Importation of high-grade ore from Bethlehem's Chilean properties constituted in the past the company's most important single flow of foreign ore. Shipments from the El Tofo concessions may terminate in a few years as the result of mine exhaustion. Imports from another Chilean concession, the El Romeral property, will amount to only a fraction of the current receipts of Bethlehem from this South American country. Thus ownership interests which in the past have furnished the major portion of Bethlehem's ore will supply a diminishing proportion of Bethlehem's requirements in years to come.

Almost all of Bethlehem's principal ore-purchase contracts are of short-term character. The exception is an agreement with Hanna Coal & Ore Corp. for delivery of 30 million tons of ore during a 25-year period from that company's share in the Quebec-Labrador deposits. Bethlehem has several agreements with domestic ore sellers for the delivery of relatively modest tonnages during the next few years. All of the New York ore consumed by the Lackawanna, N. Y., plant, for instance, is purchased from outside interests. These contracts indicate in their terms that they are in the nature of spot purchases. The company's contracts with producers in Sweden, Africa, Spain, and Australia were all of relatively short duration.

Thus it appears that, unless the company succeeds in continuing to obtain substantial tonnages of ore on a spot or long-term contract basis, it may not be in a position to keep its furnaces going at full blast. Both Lake Superior and Chilean ore are likely to shrink to some extent as sources of supply, probably as soon as 1955. Shipments from Venezuela and the tonnages of Quebec-Labrador ore bought from Hanna Coal & Ore will barely be sufficient to make up for this shrinkage. Production from Bethlehem's Pennsylvania mines cannot be expanded rapidly. Moreover, no commercial ore will be available to Bethlehem from the development of its taconite resources for some time to come. Should Bethlehem fail to receive Venezuelan and Labrador ore in the quantities it expects from these sources, it may find itself in a serious predicament.

REPUBLIC STEEL CORP.

Domestic reserves

As of January 1, 1949, Republic held ore reserves, amounting to 13.8 million tons, in the Lake Superior district. Approximately 8 million tons were held directly by the company. Of this amount,

[85] Total Lake Superior receipts of Bethlehem from its own interests in 1948 were 5.9 million tons.

over 6 million tons were of direct-shipping grade, but only 1 million tons permitted open-pit operations. Nearly 2 million tons were of concentrating grade, with roughly two-thirds to be obtained from open-pit mines.

Another 3.4 million tons of the total were held by the Susquehanna Ore Co., a mining company managed by Republic. All of this ore is direct-shipping. It is evenly divided between open-pit and underground operations.

Republic's remaining 2.3 million tons in the Lake Superior district were represented by fractional interests in mining companies managed by Pickands Mather.[86] Almost all of this ore was direct-shipping, with well over half in open-pit mines.

The company also directly controlled 12.3 million tons of "measured" reserves in New York State. All of this ore, located in the Adirondacks, requires underground mining operations; and, with the exception of half a million tons, all of it was of concentrating grade. The concentrates average 65 percent iron.

TABLE 6.—*Domestic reserves of Republic Steel Corp. as of Jan. 1, 1949*

[In 1,000 gross tons]

Properties and percent ownership	Total reserves	Direct shipping		Concentrating	
		Open-pit	Underground	Open-pit	Underground
Minnesota properties	3,310	945	560	1,195	610
Michigan properties	4,755	----------	4,755	----------	----------
Susquehanna Ore Co. (50 percent)	3,370	1,642	1,728	----------	----------
Pickands Mather report (includes Republic's ownership of 6 percent in Mahoning Ore & Steel Co. and 4½ percent in Plymouth Mining Co., and the 6 percent of the production of Hoyt Mining Co. to which it has the right under an agreement with Pickands Mather.					
Minnesota	2,254	1,228	964	56	6
Michigan	73	51	22	----------	----------
Total, Lake Superior	13,762	3,866	8,029	1,251	616
New York properties	12,275	----------	500	----------	11,775
Alabama properties	37,375	----------	4,000	1,325	32,050

NOTE.—Republic and Armco own 50 percent each in Reserve Mining Co., managed by Oglebay, Norton. Reserve Mining reported 1,440 million tons of potential ore of 23.13 percent iron.

The Alabama properties of Republic contain also, for the most part, concentrating-grade ore located underground. Development of these properties has not been as extensive as that of the company's New York deposits. More than two-fifths of Republic's 37.4 million tons "measured" reserves in Alabama were in mines as yet undeveloped in 1949. Here, too, as in New York, extensions of underground reserves may be substantial, estimates for "indicated" and "inferred" reserves being almost of the same size as "proven" tonnages. Republic puts the average iron content of its ore reserves in this district at 45 percent.[87]

[86] The company's report to the Commission stated that extensive geological surveys in this region show very substantial tonnages to exist on its properties in addition to those listed as "measured." Without further extensi e and expensive drillings, not considered warranted at the time of the company's report, company officials were reluctant to furnish an estimate of "indicated" and "inferred" reserves.

[87] This quality estimate see ns to be out of line with United States Steel's and the Bureau of Mines' estimates for the district, which are materially lower.

Republic is also a joint owner with Armco in Reserve Mining Co., which owns magnetic taconite properties on the Mesabi Range in the Lake Superior district. Oglebay, Norton is the managing agent for the properties.

Reserve Mining Co., through Oglebay, Norton, reported to the Commission in July 1950, that it owned 1,440 million tons of crude ore assaying an average iron content of 23.13 percent. This is equivalent to about 480 million tons of concentrates of about 68-percent iron content. It was stated that this tonnage could be produced by open-pit operations without rock stripping, but that at least 3 tons of crude ore would be needed to make 1 ton of concentrated ore. Labor requirements per ton were expected to be about four times what is necessary to produce a ton of open-pit direct-shipping ore from the Mesabi Range.

The company's conception of the minimum economic size of a treating plant was one which would produce 2.5 million tons annually. The investment required was tentatively estimated at from $15 to $20 per annual ton of product, exclusive of working capital. The investment, of course, would vary with such factors as location of plant, proximity of water, and tailings disposal area.[88] The cost per ton of the product could not be accurately forecast, but Oglebay, Norton believed that a cost could be obtained which would make the product competitive with deep underground direct-shipping ores. The grade of the product would depend upon whether it were to be shipped in the form of concentrate or agglomerate. The iron content would vary from 60 to 63 percent, depending upon which of the several methods of agglomeration could be economically adopted. The time required to attain full production after a decision to proceed with the project was estimated at approximately 5 years.

At the time Reserve Mining Co.'s ore reserves were reported to the Commission, ownership of the company's stock was divided as follows: Armco, 33⅓ percent; Wheeling, 33⅓ percent; Montreal Mining Co., 23⅓ percent; Cleveland-Cliffs, 10 percent. In September 1950, Reserve was acquired by Republic and Armco,[89] the two interests being evenly divided. Subsequently [90] a 15-percent interest was sold to National Steel, which, however, soon sold its stock back to Republic and Armco.[91]

Armco's interest in taconites was not of recent origin. Its Annual Report for 1949 related that the company had "continued research during the year on the commercial development of magnetic taconite ore as a substitute for natural iron ore," and told its stockholders further:

> * * * A pilot plant, located at Ashland, Ky., began operation in 1949 to determine how this ore can best be prepared for use in blast furnaces. Engineering and planning is continuing for mining the Reserve properties.[92]

In November 1950, the owners of Reserve announced plans for a large-scale pilot plant, to "produce about 300,000 tons of iron-ore

[88] "The flowsheet, which is continually being modified by research, indicates requirements of approximately 70 kilowatt hours of electricity and 48 tons of water, both per ton of agglomerate" (report to FTC).
[89] Republic Steel Corp., Annual Report for 1950, p. 11.
[90] Apparently in January 1951. Cf. New York Times, January 30, 1951, p. 37.
[91] Cf. National Steel Corp., Annual Report for 1951, pp. 7-8: "During 1951 we disposed of our interest in Reserve Mining Co. by sale to the other owners. This step was taken because we felt that our extensive holdings of other iron ore reserves made it unnecessary for us to participate in the development of taconite reserves at the present time."
[92] Op. cit., p. 19. For an account of the work at Ashland, as well as of earlier plans for Reserve's taconite plant, cf. Steelways, March 1951 (Taconite: Iron Ore Bonanza), pp. 2-5.

pellets a year," and for "the first unit of a plant with an annual capacity of 2,500,000 tons of finished product." [93] The latest information from an authentic source concerning the working out of these plans, and with respect also to Reserve's program for further expansion than appears to have been contemplated early in 1951, is to be found in Republic Steel Corp.'s Annual Report for 1951, dated March 25, 1952, which said:

> Great progress has been made by Reserve Mining Co. in the construction of facilities to mine, transport, and beneficiate this [taconite] iron ore.
>
> * * * * * * *
>
> A 300,000-ton annual capacity pilot plant at the ore deposit at Babbitt, Minn., is nearing completion. To house the workmen needed for both the open pit mine at this location and the plant, a carefully planned village to accommodate 600 employees and their families is now under construction.
>
> Contracts were let last fall for the first unit of a plant on the shores of Lake Superior to crush, concentrate and pelletize taconite ore. This unit should be finished by 1955 and will produce 2.5 million tons of pellets per year. In addition, there is a 47-mile railroad which will connect the plant and the mine as well as loading docks, a harbor, and a village at Beaver Bay, Minn. A program to expand this first unit to an annual production of 3.75 million tons has been announced. It is expected that this expansion will be completed by 1957. The product will be shared by Republic and Armco Steel Corp., equal partners in Reserve.
>
> It is planned to expand this plant to an eventual capacity of 10 million tons.
>
> The entire development will involve a total investment by Reserve Mining Co. in excess of $160 million. Because of the high quality of the finished product, this represents an attractive addition to Republic's ore reserves.[94]

Foreign holdings

In view of its domestic position with regard to ore reserves, Republic has been vitally interested in sources abroad.

It is one of the five steel companies associated in the Quebec-Labrador venture in Canada. With a 25-percent interest in Iron Ore Co. of Canada, it is the largest stockholder next to the dominant Hanna interests.[95] An officer of M. A. Hanna Co. stated to the Commission that the five steel companies—

> * * * were selected because they were old customers of the Hanna Co. and it was desired that they should continue to be their customers, and, in order for them to continue, it was necessary for new supplies to be developed.

Iron Ore Co. of Canada informed the Commission that it expected shipments to begin in 1954, though its announced goal was 1955.[96] Maximum annual production is expected to be reached in 1957 or 1958, at which time 10 million tons of ore are expected to be shipped. When this goal is reached, Republic will be entitled to 2.5 million tons annually of the Quebec-Labrador ore.

Republic reported that it holds a majority interest in Liberia Mining Co., Ltd., which holds an iron-ore concession in Liberia.[97]

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[93] Republic Steel Corp., Annual Report for 1950 (March 20, 1951), p. 11. "Advantage," it was said, would "be taken of a plant [already] on the property to establish [the] pilot operation." Cf. Armco Steel Corp., Annual Report for 1950 (March 20, 1951), p. 16: "Construction has begun on a large pilot plant near the [Reserve's] mines which will produce approximately 300,000 tons of high-grade iron ore annually. It is expected to be in operation early in 1952. Constructing the plant, opening the mine, and building a new town for employees will cost approximately $7,500,000." Republic (op. cit., reported at the same time regarding the larger project: "In the meanwhile, engineering is being completed on the first unit of a plant with an annual capacity of 2,500,000 tons of finished product, on a mining town and a railroad from the mine to Beaver Bay on Lake Superior. These units will represent an expenditure of $60,000,000. The entire development and construction program will call for another $100,000,000."

[94] Op. cit., pp. 8–9. Cf. also Armco Steel Corp., Annual Report for 1951, p. 19.

[95] Since this project is being developed by the Hanna group, it is more fully discussed in the section devoted to National Steel Corp., the steel manufacturing affiliate of M. A. Hanna Co. Other steel companies associated in the project are Armco, Youngstown Sheet & Tube, and Wheeling.

[96] It appears probable that shipments will start in 1954. Cf. pp. 119–120.

[97] Republic Steel Corp. owns 61.57 percent of the voting power in Liberia Mining Co., Ltd. (Moody's Manual (Industrials), 1951, p. 2374). The ownership of the remainder of the stock is unknown. Republic reported to the Commission that no other steel company is among the owners.

This concession, granted by the Liberian Government, is for a period of 80 years.[98] Explorations have "proven" 15 million tons of reserves of 65–68 percent iron of open-hearth grade. Although exploration is continuing, "indicated" and "inferred" tonnages were estimated at 35 million tons. The ore will be mined by open-pit methods in the beginning; later extraction will be from underground mines.

The first shipment arrived at Baltimore in June 1951. The company reported that 750,000 tons were expected to be shipped during the first year of production and a 1-million-ton maximum thereafter.[99] Though regular shipments have been made since June 1951, it is not known whether the goal for the first year's operation was attained; but the company believes that "in 1952 shipments should total approximately 1 million tons." [1] Republic has an option to purchase 66 percent of the iron ore produced and also first call on the remain percentage at market prices. Republic expects to use the entire production,[2] except a small amount which may be sold to establish a market for this type of ore.

Republic also reported to the Commission that it is sole owner of Compania Minera La Republica, S. A. (Mexico), which owns iron-ore rights in the State of Vera Cruz, Mexico. It stated that these properties have not been developed to a producing status.

Since the inception of the Commission investigation, Republic has also become interested in Venezuelan ore reserves. In its annual report for 1951 the company announced:

> Twelve iron-ore concessions in Venezuela, containing substantial tonnages of acceptable ore, have been secured by the Maria Luisa Ore Co. from Venezuelan owners. Each concession consists of approximately 1,235 acres.
>
> The Maria Luisa Ore Co. is owned jointly by the Hanna Coal & Ore Corp. and Republic Steel Corp.[3]

Competitive position

In 1948 Republic, the Nation's third-ranking steel producer, obtained less than half of its iron-ore requirements from production by mines in which it had ownership interests. Total receipts of ore from all sources by the company's furnaces in that year were below requirements, forcing Republic to reduce the stocks of iron ore at its plants by half a million tons.

Republic's ore-mining interests in the Lake Superior district are the smallest among those of the nine steel producers for which data were obtained. Most of its Lake Superior ore is in wholly owned mines and in properties of Susquehanna Ore Co.[4] At 1948 production

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[98] Liberia Mining Co.'s concession is located about 45 miles northeast of the seaport capital of Monrovia in the Bomi Hills, and, according to Republic's statement to the Commission, "covers radius of 40 miles from Bomi Hills." For further details concerning the Liberian development, cf. Steelways, September 1951 (Iron Boom in Liberia), pp. 21–24.

[99] Cf. Republic Steel Corp., Annual Report for 1951 (Mar. 25, 1952), p. 8: "A total of 167,000 tons of Liberian ore was shipped in 1951."

[1] Loc. cit.

[2] While it appears that ore could be shipped not only to Baltimore but to Mobile, Republic's Annual Report for 1951 stated (p. 8) that "the ore is unloaded in Baltimore and shipped by rail to Republic's furnaces." The report also said (p. 11): "Work is progressing satisfactorily on the construction of several 25,000-ton oceangoing cargo carriers to be operated by a company in which Republic will have a 50-per ent interest. The first two * * * will be in service by mid-1952. These vessels will carry Liberian ore to this country and at a later date transport ore from Labrador to Baltimore until such time as the St. Lawrence seaway can be built."

[3] Op. cit., p. 10. Cf. also M. A. Hanna Co.'s 1951 Annual Report: "The exploratory work conducted during the past year on the property in Venezuela, known as Maria Luisa * * *, indicated a substantial tonnage of iron ore of acceptable grade and the property was purchased by a company owned jointly by Republic Steel Corp. and ourselves. This substantially increases the reserves which we have owned in this same general district of Venezuela for the past 20 years."

[4] Lake Superior ore has been the principal source of raw material for six of Republic's plants, five of them located in northeastern Ohio, and the sixth at South Chicago, Ill. The Ohio plants have been consuming also some ore mined in the northeastern district and modest quantities imported from Canada.

levels, Republic's open-pit reserves of both direct-shipping and concentrating grades in this district may be exhausted by 1953 or 1954. The company's reserves of underground ore are not large enough to outlast open-pit reserves by very long, based on the rate of exploitation in the past. There is reason to believe, therefore, that Republic's Lake Superior reserves will be exhausted in the immediate future.

Substitution of ore from other domestic properties of Republic in time to conserve the tonnage remaining in the Lake Superior district appears unlikely. Republic's only other mining properties, which supply the Ohio plants as well as the company's blast furnaces at Buffalo and Troy, are located in the Adirondacks in New York State. For the most part, the ore from these mines has to be concentrated and requires underground mining operations. Rail-transportation costs make the consumption of New York ore at the Ohio locations a fairly expensive undertaking.

Republic's current expansion program will lead to a substantial increase in the company's raw-material requirements at near-capacity levels of output.[5] As its ore-producing properties are able to fill a steadily decreasing proportion of its total ore requirements, Republic will have to obtain larger and larger quantities of ore from purchases and from its foreign holdings now under development. On the basis of its ownership interests, Republic will be entitled to 25 percent of the annual production of Quebec-Labrador for the first 25 years of production. Production from these properties, however, is not expected to get under way until 1954 at the earliest. Until 2 or 3 years later, when the estimated maximum output of 10 million tons a year will be reached, Republic cannot expect significant shipments from this source.

As for receipts from the company's Liberian interests, it is doubtful that Republic will be able to obtain more than 1 million tons of ore per year from that source during the next few years. No plans have been made for the development of Republic's Mexican properties; therefore, this ore cannot enter into calculations of the company's raw-material-supply budget.[6] Republic has an interest in the taconite deposits held by the Reserve Mining Co., but any considerable supplies from this source also will not be available for some years.

Contracts for the delivery of ore with two of the most important domestic producers of ore will provide Republic with some of the ore it requires.[7] In addition, the company has been buying moderate quantities of Canadian ore, which it imports through Great Lakes ports. But the assured future receipts from all known sources of supply for Republic's plants located in the Great Lakes area, on the basis of current ownership and purchase arrangements, fall short of estimated requirements. A deficit appears probable until Republic can obtain its full quota of ore from the Quebec-Labrador project. If shipments from Canada and Liberia fall short of the expectations

[5] Under present plans for expansion, Republic will add 1.4 million tons to the steel capacity of its Cleveland plant. In this connection it should be noted that Republic's expansion plans are more modest in character than those of three of its smaller competitors, National, Armco, and Jones & Laughlin.

[6] Plant location will undoubtedly determine the economic practicability of the utilization of foreign ores. While it is conceivable that the company's Ohio plants may benefit from both Liberia and Labrador imports and its Alabama plants at least from Liberian shipments, it is not likely that any of the foreign ore will go to the South Chicago, Ill., plant.

[7] From data reported to the Commission and the testimony of officials of United States Steel and Republic Steel, it is apparent that Republic has an informal agreement with United States Steel for the delivery of up to 1.1 million tons a year by Oliver until 1955. According to a Republic official, his company has an option to take additional quantities of Oliver ore extending through 1964 or 1965 (Celler committee hearings, serial No. 14, pt. 4A ("Steel"), pp. 224-225, 558-563).

of the company, Republic may face a serious supply problem. Its dependence on Oliver will certainly be increased.

Republic has two plants in the southeastern district. One, at Gadsden, Ala., possesses both blast and steel-making furnaces; the other, at Birmingham, Ala., possesses blast furnaces only. In 1948 these plants consumed ore mined in the States of Alabama, Georgia, and Tennessee, though in other years their ore came from such widely different origins as New York, Michigan, Missouri, Texas, and even Brazil. Republic's underground deposits of ore, mostly of concentrating grade, furnished about one-half of the million tons which the two plants required in 1948. The remainder was purchased from small producers of brown ore in the district. The raw-material supply of the two Alabama plants should not be a serious problem in the foreseeable future.

JONES & LAUGHLIN STEEL CORP.

Domestic reserves

This company's total reserves in the Lake Superior district as of 1949 amounted to 56 million tons. Most of this tonnage, approximately 40.8 million tons, was held by Inter-State Iron Co., wholly owned and controlled by Jones & Laughlin. Another wholly owned subsidiary, Jones & Laughlin Ore Co., reported reserves of 13.6 million tons in the State of Michigan.

Most of this ore is direct-shipping, but a large portion (including all the Michigan ore) can be produced only by underground mining methods. Of the total of 42 million tons of direct-shipping ore reserves, nearly 32 million involved underground operations. The remaining 14 million tons of reserves were of concentrating grade, of which all but a small proportion could be obtained from open-pit operations.

TABLE 7.—*Domestic reserves of Jones & Laughlin Steel Corp. as of Jan. 1, 1949*

[1,000 Gross tons]

Companies and percent ownership	Total reserves	Direct-shipping		Concentrating	
		Open-pit	Underground	Open-pit	Underground
Jones & Laughlin Ore Co. (100 percent), Michigan [1]	13,642	----------	13,642	----------	----------
Inter-State Iron Co. (100 percent), Minnesota	40,871	9,284	18,275	11,935	1,377
Mesaba-Cliffs Mining Co. (11.7 percent)	1,536	19	----------	1,517	----------
Total Lake Superior	56,049	9,303	31,917	13,452	1,377
Jones & Laughlin Ore Co. (100 percent), New York properties	51,300	----------	----------	34,500	16,800

[1] Includes the reserves on undeveloped properties of Lucky Star Mining Co., Bunker Hill Mining Co., and Arctic Iron Co., in which Jones & Laughlin shares ownership with Cleveland-Cliffs. Jones & Laughlin is entitled to the reserves in proportion to its stock interests in the three companies: 75 percent, 31.933 percent, and 50 percent, respectively. The total reserves of these properties were not reported, but were allocated and included in the total reserves reported by Jones & Laughlin Ore Co. and Cleveland-Cliffs.

Jones & Laughlin's reserves in the Lake Superior district were almost equaled in size by its reserves in New York State. The company reported "measured" reserves in that area amounting to 51.3 million tons, all of concentrating grade. Approximately two-thirds of this total was located in open-pit mines. The iron content of the

sintered product averages 62 percent for the open-pit and 63 percent for the underground portion of the deposits.[9]

Foreign holdings

This company's foreign holdings are insignificant compared to those of the steel companies previously discussed. Jalore Mining Co., Ltd., a subsidiary of Jones & Laughlin, reported to the Commission that it has a 50-year lease on 1,400 acres of iron-ore properties north of Michipicotaen Harbor, Ontario. "Measured" reserves in the Ruth and Lucy claims were estimated to be 23.4 million tons of sintered product, with another 10 million tons "indicated." The ore contains about 50 percent iron with various impurities, and is underground, but at a shallow depth. No production and delivery plans have been developed.

Magdalena Mining Co., another wholly owned subsidiary, reported that it owned properties containing 5,537 acres in the Province of Oriente, Cuba. Reserves of 20 million tons of nodulized or sintered product, of 47-percent iron with impurities, have been proven there. Plans for development of the properties are indefinite.

Competitive position

Jones & Laughlin supplied three-fourths of its 1948 ore requirements from its own mining interests. The company's three plants located in Pittsburgh, Aliquippa, and Cleveland consumed, for the most part, Lake Superior ore, and, to a lesser extent, concentrates from New York State ore deposits. All of the New York ore came from the company's own reserves; some of its Lake Superior ore was obtained on contract.

At 1948 levels of production, the company's New York State reserves will serve as a source of supply for many years to come. The Lake Superior reserves, similarly, may continue to supply ore for more than a decade if production of underground and concentrating-grade ores can be sufficiently increased within the next 10 years to replace the company's open-pit direct-shipping ore,[10] which may be exhausted within that period. This eventual substitution of higher-cost ore appears to be feasible quantitatively, since Jones & Laughlin reported no production from its Lake Superior underground and concentrating-grade ores in 1948, although the reserves of these types of ore totaled 32 and 15 million, respectively.[11]

In the past Jones & Laughlin has depended on the open market for a portion of its ore requirements. One contract currently in force will supply ore equal to from 20 to 25 percent of its future blast-furnace requirements.[12] A second contract will supply approximately one-quarter million tons for several years.[13] Although the company is planning to expand its steel-making capacity by 1.6 million tons by 1953, its ore reserves apparently will be sufficient to permit capacity operations until production from its underground and concentrating-grade reserves can be expanded.

[9] The company reported high estimates for the extensions of its "proven" tonnages in Michigan and New York. If these estimates prove correct, the reserves of Jones & Laughlin will be nearly twice as large as presently "measured" tonnages. The company also stated that low-grade iron-bearing material is known to be present on all of its properties, but that explorations have not yet been made and that, therefore, no basis exists for estimating the tonnage or grade of this material.

[10] In 1948 the company produced 1 million tons of open-pit, direct-shipping ore.

[11] The company's comparatively favorable supply situation is reflected in its lack of interest in developing its foreign properties in Canada and Cuba. This is further indicated in the company's statement to the Commission that no explorations of taconite deposits, known to be present on all of its ore properties, have taken place.

[12] Maximum tonnage in any 1 year is not to exceed 1.7 million tons.

[13] The first contract is with Cleveland-Cliffs Iron Co., the second with Oliver Iron Mining Co.

YOUNGSTOWN SHEET & TUBE CO.

Domestic reserves

All of the ore reserves of this company are under the management of Pickands Mather. The ore house, in its report to the Commission, listed 18 companies in which Youngstown has ownership interests. Many of Youngstown's interests parallel those of Bethlehem.

At the beginning of 1949 the company had 46.4 million tons of ore reserves, all located in the Lake Superior district. All but 7.5 million tons was direct-shipping ore. However, over half of the total, approximately 25.5 million tons, required underground operations. The remaining 13.5 million tons could be obtained by open-pit operations. Of the 7.5 million tons of concentrating grades, a little over half was open pit.

Youngstown is a partner in Erie Mining Co., owner of taconite lands in Minnesota, which is under the management of Pickands Mather. Erie has been operating an experimental taconite plant at Aurora, Minn., since 1948.[14]

TABLE 8.—*Domestic reserves of Youngstown Sheet & Tube Co. as of Jan. 1, 1949*

[In 1,000 gross tons]

Company	Total reserves	Direct-shipping		Concentrating	
		Open-pit	Underground	Open-pit	Underground
Michigan properties (Pickands Mather report)	7,614	228	7,386		
Minnesota properties (Pickands Mather report)	38,805	13,222	18,108	4,442	3,033
Total	46,419	13,450	25,494	4,442	3,033

NOTE 1.—Pickands Mather also allocated 245,000 tons of open-pit and 37,000 tons of underground direct-shipping manganiferous ores to Youngstown, in proportion to its stock interests in certain mining companies managed by Pickands Mather.

NOTE 2.—Youngstown has a 45-percent ownership in Erie Mining Co., a taconite development managed by Pickands Mather. Erie Mining reported 539 million tons of 64-percent iron.

Foreign holdings

Youngstown has a 10-percent interest in Iron Ore Co. of Canada, owner of the Quebec-Labrador iron ore concessions. Iron Ore Co. of Canada estimated that production would begin in 1954–55, and that by 1957–58 annual production would be 10 million tons. Hence, by the latter date, Youngstown may be importing 1 million tons of ore from Quebec-Labrador.[15]

Youngstown is also one of a group of steel companies that obtained concessions in the Steep Rock Lake area in Ontario, Canada, late in 1950. Since no information is available concerning the results of exploration, it is not possible to estimate when and in what quantities the company might be receiving ore from this source.[16]

Competitive position

Shipments from Youngstown's domestic mining properties furnished about 70 percent of the company's 1948 ore requirements. The company's open-pit reserves of both grades may last until some time in the latter part of this decade if depletion continues at the 1948 rate.

[14] Cf. pt. IV, Bethlehem Steel Corp., pp. 102–103, for an account of Erie's taconite research and proposed expansion.

[15] For a discussion of the Quebec-Labrador development, cf. pt. IV, National Steel Corp., pp. 117–120.

[16] Cf. pt. IV, Inland Steel Co., pp. 123–127, for a synopsis of the Steep Rock development.

The life expectancy of the total underground reserves is almost twice as long at the same rate of exploitation.

Youngstown's eventual receipts from Canadian interests may in a few years partially replace shipments from its rapidly shrinking Lake Superior open-pit reserves. Pressure on the company's domestic open-pit direct-shipping reserves may, however, be alleviated by an increase in production from the company's larger reserves of underground direct-shipping ore.

By 1953 Youngstown expects to enlarge the steel- and pig-iron-making facilities of its East Chicago, Ind., plant by a million tons and half a million tons, respectively, over their 1948 capacity. The increased ore requirements resulting from this expansion may force the company in the near future to increase production from its properties managed by Pickands Mather and to purchase more in the domestic market.[17] Two contracts the company has with sellers of ore provide for the annual delivery of a maximum of 1.3 million tons of ore through 1954, and 2 million tons per year for another 10 years.[18]

Even after allowance is made for these two contracts, Youngstown probably will have to fill much of its future ore requirements from sources other than those already named. Small tonnages may be purchased from Canadian ore merchants.[19] There is some possibility that in view of ties with Pickands Mather and Interlake, Youngstown may be supplied with ore and pig iron, respectively, by those companies should the need arise.[20]

Unless Youngstown succeeds in contracting for additional quantities of ore, or in greatly expanding production from its underground mines, it may experience difficulty in assembling the raw materials necessary for capacity operation. In the long run, too, Youngstown depends heavily upon the success of the Labrador and Steep Rock ventures. A failure of these projects to develop according to plan would considerably aggravate the company's problems.

NATIONAL STEEL CORP.

Domestic reserves

National owned 91.1 million tons of ore reserves on January 1, 1949, all located in the Lake Superior district. The company controls its reserve properties through a wholly owned subsidiary, the Hanna Iron Ore Co. The latter has mines in the States of Minnesota and Michigan for which were reported total reserves of over 56.6 million tons. All of its 18.8 million tons of Michigan ore was of direct-shipping grade and located underground. Of its Minnesota ore, 31.8 million tons was of concentrating grade, most of it in open-pit mines (see table 9).

Hanna Iron Ore Co. has investment interests in a number of ore-producing companies. The company reported ownership in such companies in the following percentages:

	Percent
Hanna Ore Mining Co	70
Mahoning Ore & Steel Co	7
Mahland Ore Co	50
Mesaba-Cliffs Mining Co	10.7
Susquehanna Ore Co	25
Richmond Iron Co	66⅔

[17] In 1948 Youngstown received approximately 3.75 million tons from its properties managed by Pickands Mather, and purchased 1.7 million tons in the domestic market, most of which was under long-term contract.
[18] These contracts are with Oliver Iron Mining Co. and Cleveland-Cliffs Iron Co.
[19] Canadian purchases by Youngstown in 1948 amounted to 79,000 tons.
[20] Cf p. 73, note 18.

By far the most important of these interests is the 70-percent stock ownership in Hanna Ore Mining Co. Of the 29.2 million tons of reserves of this company which were allocated to Hanna Iron Ore (constituting, therefore, National's share), 18.3 million tons were underground direct-shipping ores. Open-pit reserves totaled 8.2 million tons, about equally divided between direct-shipping and concentrating-grade ores.[21]

Two ore houses and one of the major steel companies manage Hanna Iron Ore's remaining interests. A 10.7-percent interest in Mesaba-Cliffs Mining Co. (managed by Cleveland-Cliffs) gave Hanna Iron Ore, and thus National, a claim to 1.4 million tons of open-pit concentrating-grade ore. Hanna Iron Ore's 7-percent interest in Mahoning Ore & Steel Co. (managed by Pickands Mather) represented some 2.2 million tons of direct-shipping ore, the larger proportion of which could be derived from open-pit mines. Hanna Iron Ore's participation in the ownership of Susquehanna Ore Co., managed by Republic, added another 1.7 million tons of direct-shipping ore, half of it in open-pit and half of it in underground mines, to the steel company's ore supply.

TABLE 9.—*Domestic reserves of National Steel Corp. as of Jan. 1, 1949*

[In 1,000 gross tons]

Companies and percent ownership	Total reserves	Direct-shipping		Concentrating	
		Open-pit	Underground	Open-pit	Underground
Hanna Iron Ore Co. (100 percent):					
Minnesota	37,869	2,500	3,512	23,238	8,619
Michigan	18,774		18,774		
Hanna Ore Mining Co. (70 percent)	29,168	3,802	18,309	4,443	2,614
Mesaba-Cliffs Mining Co. (10.7 percent)	1,405	17		1,383	
Susquehanna Ore Co. (25 percent)	1,685	821	864		
Mahoning Ore & Steel Co. (7 percent)	2,237	1,228	943	66	
Total	91,138	8,368	42,402	29,135	11,233

NOTE 1. Mahland Ore Co., 50-percent owned by Hanna Iron Ore Co., reported no reserves.
NOTE 2. Richmond Iron Co. (66⅔ percent), 2 million tons of direct-shipping open-pit high-siliceous ore allocated to Hanna Iron Ore Co. on the basis of its 66⅔-percent ownership.

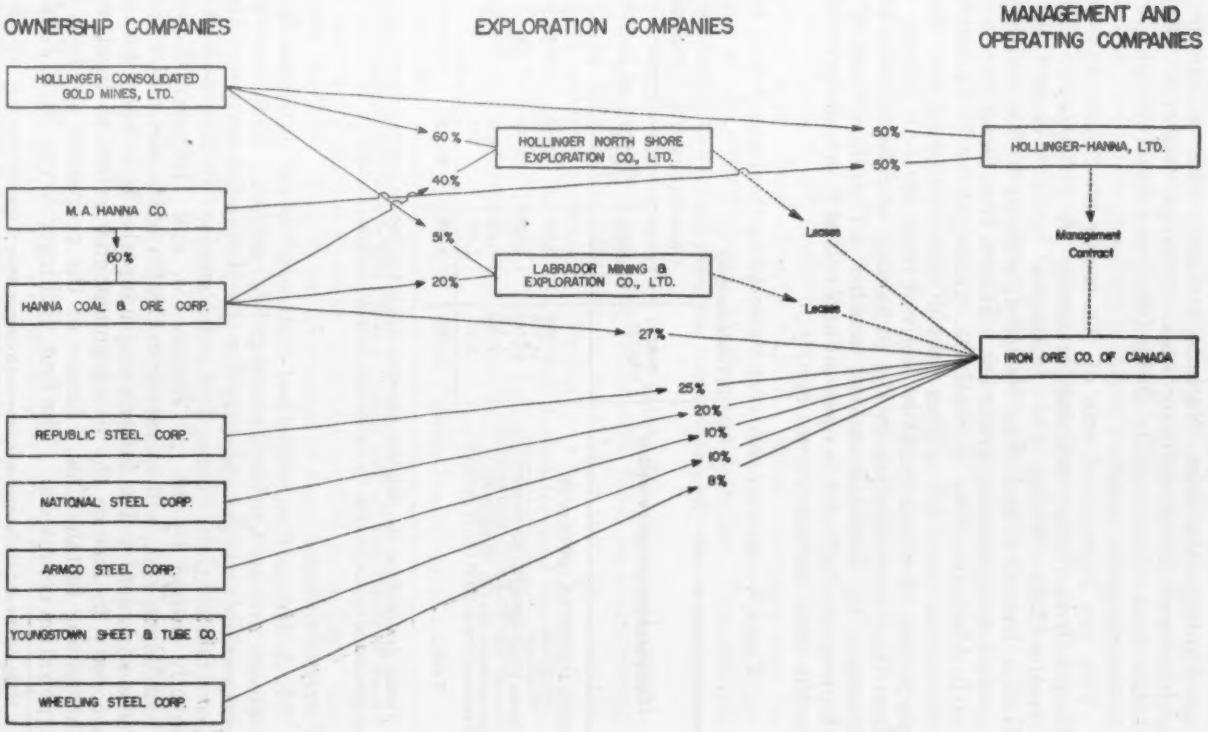
Foreign holdings

M. A. Hanna Co., affiliate of National,[22] is the dominant American interest in the Quebec-Labrador ore project. This venture is a partnership arrangement between the Hanna interests and Hollinger Consolidated Gold Mines, Ltd., of Canada. Hollinger-Hanna, Inc., equally owned by M. A. Hanna Co. and Hollinger Consolidated Gold Mines, Ltd., will operate Iron Ore Co. of Canada under a management contract.[23] The latter's major function is to issue the securities necessary to finance the development and to act as legal owner of the mining installations. Leases of the properties are held by two exploration companies. The first, Hollinger North Shore Exploration

[21] Mahland Ore did not list any ore reserves on its properties as of the reporting date. Company officials, however, indicated the possibility that exploration and development work, once undertaken, might prove the presence of commercial ore on the lands of the company.
[22] It should be noted that M. A. Hanna Co., with 27.18-percent stock ownership in National Steel, has effective control of the company. Cf. earlier discussion, pp. 27–28.
[23] Leases on the property managed by Iron Ore Co. of Canada are held by Hollinger North Shore Exploration Co., Ltd. (60-percent owned by Hollinger and 40-percent by Hanna Coal & Ore), and Labrador Mining & Exploration Co., Ltd. (51-percent owned by Hollinger and 20-percent by Hanna Coal & Ore). Cf. chart XX.

CHART XX

HOLLINGER-HANNA OWNERSHIP IN QUEBEC-LABRADOR



Co., Ltd., holds a license which entitles it to explore, but not to mine, an area of 3,900 square miles in Quebec adjacent to the Labrador boundary. The mining area will encompass 500 square miles. When the company commences mining operations it will have an option of taking an operating lease for 20 years, renewable for three additional periods of 20 years each. The second exploration company, Labrador Mining & Exploration Co., Ltd., holds a concession of 20,000 square miles in Labrador, adjoining the Quebec concession of Hollinger North Shore Exploration Co., Ltd.[24]

As reported to the Commission, Iron Ore Co. of Canada, a Delaware corporation organized in November 1949, has been given the conditional right to lease a large part of the iron ore reserves in both concessions from the exploring companies. At present the properties consist of mining concessions covering 500 square miles in the Knob Lake area, where the Quebec and Labrador Provinces meet. In Labrador the company has an option to take 30-year leases, with a right to two renewals of 30 years each. In Quebec it has an option to take 20-year leases, with a right to three renewals of 20 years each.[25]

Iron Ore Co. of Canada reported to the Commission that its ownership is divided as follows:

	Percent
Hanna Coal & Ore Corp	27
National	20
Republic	25
Armco	10
Youngstown Sheet & Tube	10
Wheeling	8

Since Hanna Coal & Ore Corp. and National own, in combination, 47 percent of the Iron Ore Co. of Canada, it is clear that the Hanna-Hollinger interests have control. The other steel companies are essentially investors in the project, with rights in the ore to be produced in the future.[26] All five steel producers have the right to contract for the purchase, during the first 25 years of production, of a proportion of the annual production equal to the percentage of stock owned by each producer.[27]

By the close of 1950 "the drilling program [had] * * * proven well over 400 million tons of high-grade open-pit ore, with prospects for large additional tonnages."[28] Exploration continued during 1951. "In the Labrador concession, more than 18,000 linear miles were flown in an extensive aerial magnetometer survey for the purpose of finding extensions of iron formation in areas of little outcrop. By continuing the geologic mapping program, some new iron-ore prospects for future testing were discovered. Near the end of the season another major ore body was found by the prospectors. The find was followed up by trenching and some drilling."[29]

Iron Ore Co. of Canada reported to the Commission in April 1951, that the company expected shipments to begin in 1954, though the

[24] Memorandum of May 13, 1946, Department of Mines and Resources, Dominion of Canada.
[25] Business Week, September 23, 1950, p. 92.
[26] An officer of Hanna stated that the five steel companies "were selected because they were old customers of the Hanna Co. and that it was desired that they should continue to be their customers, and, in order for them to continue, it was necessary for new supplies to be developed." Further, as the total tonnage of ore shipped from Seven Islands increases, the amount of ore available to the Hanna Co. for sale on the open market will also rise. However, he expressed the belief that the steel companies having an interest in Iron Ore Co. of Canada would have priority on any additional tonnage.
[27] A news magazine reported that if domestic steel production drops below 66⅔ percent of ingot capacity, the steel companies can buy less in proportion to the production rate (Business Week, September 23, 1950, p. 92).
[28] M. A. Hanna Co., annual report for 1950.
[29] M. A. Hanna Co., annual report for 1951.

WHEELING STEEL CORP.

goal set had been 1955. Maximum annual production is hoped to be reached in 1957 or 1958, at which time 10 million tons of ore are expected to be shipped to the investor steel companies. When this production schedule is realized, National will have the right to contract for the purchase of 2 million tons annually for the first 25 years of production.

The company stated that production would require the construction of a 365-mile railroad in Canada and the construction of docks and loading facilities on the St. Lawrence River, at an estimated cost of 150 to 250 million dollars.[30] By the date of its annual report for 1951 (February 15, 1952), M. A. Hanna Co. was able to say concerning the progress of the construction program: "Building the railroad from Seven Islands northward to the ore deposits progressed about on schedule in 1951. * * * It now seems likely that iron ore can begin to move over the railroad by the summer of 1954. * * * The only long tunnel * * * and the only long bridge * * * to be needed, * * * are nearing completion. During 1951 * * * work was begun on the Seven Islands terminal and ore-handling facilities." [31] Proposed shipping routes are to Lake Erie and Atlantic ports. The project will not depend upon the construction of the St. Lawrence seaway, although transportation costs and in-transit time would be lowered if the seaway were built. The company estimated that, of the projected 10-million-ton production, 5 to 8 million tons could be shipped on the St. Lawrence River during the season, which lasts 7 to 8 months. Three million tons could be shipped via water to Montreal, and from there by rail to the Youngstown and Pittsburgh areas. One to two million tons will probably be shipped to Baltimore and Philadelphia by water. Hollinger-Hanna, Ltd., believes that the price will be competitive with Mesabi ore delivered to Cleveland.

Competitive position

Like United States Steel, National has been virtually independent of outside interests for its ore supply.[32] Comparatively small quantities of Canadian ore are the only other source besides Lake Superior ore upon which the company's blast furnaces at Buffalo, N. Y., Weirton, W. Va., and River Rouge, Mich., have been drawing in the past. However, if its reported "measured" reserve tonnages of open-pit direct-shipping ore, amounting to 8.4 million tons, are indicative of the actual amount of low-cost ore available to the company, it will soon have to substitute higher-cost ore for the 1.7 million tons of open-pit direct-shipping ore its mines produced in 1948.[33]

Successful substitution will depend on whether or not production from National's relatively large developed and undeveloped underground and concentrating-grade reserves can be expanded rapidly enough by 1953 or 1954 to fill the gap. None of the Quebec-Labrador ore of Iron Ore Co. of Canada, in which National is interested, can be expected to accomplish much toward relieving the pressure until 1957

[30] For a summary account of the "long-term financing program for developing the properties" of Iron Ore Co. of Canada, cf. M. A. Hanna Co. Annual Report for 1950.

[31] Op. cit. Cf. also Business Week, April 5, 1952, p. 106: "Iron ore from Labrador and Quebec will start moving to steel mills by the summer of 1954, a year ahead of schedule," says J. R. Timmins, president of Labrador Mining & Development Co., Ltd. "Exploration for new deposits has been discontinued," he said, "so the company can concentrate on developing the known reserves."

[32] E. T. Weir, the company's president, characterized the situation of his company as follows: "Excepting United States Steel Corp., our company, National Steel, is certainly as well protected as to iron ore as any other steel company" (Celler committee hearings, serial No. 14, pt. 4A ("Steel"), p. 812).

[33] No estimates for "indicated" and "inferred" reserves were included on the company's reports.

or 1958. National, however, not only has no doubt that shipments of this ore will commence in 1954 but anticipates considerably increased amounts the following year.[34] Yet, until the Quebec-Labrador mines attain maximum production, it seems probable that National's plans for a proposed new steel plant on the eastern seaboard will remain as tentative as when they were outlined in the company's annual report for 1950.[35]

Currently National does not have significant contractual arrangements with any of the principal sellers of ore. However, the company should be in a position to obtain without difficulty whatever portion of its needs it has to fill through purchases of ore. The close relationship between National and the Hanna mining interests appears to assure National preferential treatment as a customer by the ore house whenever temporary deficits in its ore supply may arise.

INLAND STEEL CO.

Domestic reserves

This company reported that, as of January 1, 1949, it controlled nearly 50 million tons of ore reserves in the Lake Superior district. A large portion, approximately 35 million tons, was in mines wholly owned by Inland. The entire quantity, with the exception of 2.2 million tons of open-pit ore, was direct-shipping material, located underground.

The remainder of Inland's ore reserves was in mining properties in which Inland has investment interests. The steel company owns 30 percent of the class B stock of Consumers Ore Co., managed by M. A. Hanna.[36] Though Consumers Ore did not itself report any reserves, it has a 78.5-percent interest in Butler Bros., another Hanna affiliate, which holds reserve properties. On the basis of these ownership connections, 5.2 million tons of the reserves held by Butler Bros. were allocated to Inland. Most of this ore was of concentrating grade, with some 3.5 million tons located in open-pit mines. Inland also owns a half interest in Philbin Mining Co., another company managed by Hanna. This interest entitled the steel company to 1.3 million tons of reserves, about half of which was direct-shipping, open-pit ore. Most of the remainder was concentrating-grade ore, divided between open-pit and underground mines. (See table 10.)

Inland has a half interest in the Atkins mine, which represented a reserve of another 400,000 tons of direct-shipping open-pit ore. This mine is under the management of Cleveland-Cliffs Iron Co.,

[34] National Steel Corp. Annual Report for 1951, p. 7: "Shipments from the Labrador-Quebec mines will begin in 1954, and we are confident that liberal quantities will be received in 1955."

[35] Op. cit., p. 7: "We have acquired an ideal site for the new plant on the Delaware River in New Jersey about 10 miles south of Camden. The property, covering 2,400 acres, is particularly well suited for construction of a steel plant; and, in addition, it has the outstanding advantage of navigable tidewater that is 40 feet deep at our location. This means that large ships will be able to come directly into the plant docks to bring raw materials and take away finished steel. Iron ore will come down from the Labrador-Quebec in oceangoing carriers which will afford important savings in the cost of this basic material. Having acquired the property only recently, we naturally have not as yet made final plans regarding the type of facilities we will install at the eastern location. At present we are concentrating on the large expansion program at our other plants, but preparations are being made to place the eastern plant on our construction schedule at the earliest appropriate time." The text accompanying a map showing "the site of National Steel Corporation's proposed new steel plant on the eastern seaboard" (inside of back cover of the report) emphasizes the importance for the plant of Canadian ore: "Iron ore for the plant's blast furnaces will be brought from the Labrador-Quebec field, in which National is heavily interested. The ore will be transported directly to the plant docks in oceangoing carriers via the St. Lawrence River and the Atlantic Ocean."

[36] A recent prospectus (Listing Statements of the New York Stock Exchange, A-14190, Inland Steel Co. March 28, 1952, prospectus of March 5, 1952, p. 50) indicates that, since its report to the Commission, Inland has acquired 21 percent of the class A stock of Consumers Ore. Since the reserves controlled by this company are apparently divided on the basis of ownership of class B stock, the acquisition should make no difference in Inland's rights to ore, though it would seem to mean for Inland a greater voice in decisions which might affect the rate of ore production.

which holds the other half interest in the property. Inland also has a 14.2-percent interest in Mesaba-Cliffs Mining Co., also managed by Cleveland-Cliffs. This yielded Inland another 1.9 million tons of reserves, virtually all of open-pit concentrating grade.

In addition, Inland has a 25-percent interest in Lake Mining Co., managed by Pickands Mather. This entitled the steel company to 4.3 million tons of direct-shipping ore, nearly two-thirds of which was derivable from underground mines. Inland's 25-percent interest in in Susquehanna Ore Co., managed by Republic, added 1.7 million tons of reserves. This ore was all of direct-shipping grade, and was about evenly divided between open-pit and underground operations.

TABLE 10.—*Domestic reserves of Inland Steel Co. as of Jan. 1, 1949*

[In 1,000 gross tons]

Properties and percent ownership	Total reserves	Direct-shipping		Concentrating		Potential ores
		Open-pit	Underground	Open-pit	Underground	
Consumers Ore Co. (30 percent class B stock)[1]	5,256	597	86	3,576	997	----------
Atkins Mine (50 percent)	421	421	----------	----------	----------	----------
Mesaba-Cliffs Mining Co. (14.2 percent)	1,864	23	----------	1,841	----------	----------
Philbin Mining Co. (50 percent)	1,272	683	24	362	203	----------
Susquehanna Ore Co. (25 percent)	1,685	821	864	----------	----------	----------
Lake Mining Co. (25 percent)	4,297	1,559	2,738	----------	----------	----------
Mesabi range mines [2]	16,829	2,208	14,621	----------	----------	----------
Menominee range mines [3]	10,961	----------	10,961	----------	----------	----------
Marquette range mines [3]	7,161	----------	7,161	----------	----------	----------
Total (all Lake Superior)	49,746	6,312	36,455	5,779	1,200	[4] 7,366
Total reported by Inland [1]	31,180	6,475	36,477	6,756	1,472	[4] 7,366

[1] Differences in the reserve totals due to allocation of reserves to Consumers Ore Co. from Butler Bros. The reserves of Philbin Mining Co. and South Agnew Mining Co., allocated to Butler Bros., have not been included in the reserves allotted to Consumers Ore on the basis of its 78.556 percent ownership in Butler Bros.

[2] From wholly owned mines.

[3] From wholly owned mines except for 47,000 tons of direct-shipping underground ores allocated on the basis of a 62½-percent ownership in Crystal Falls mine.

[4] 64 Fe.

Inland Steel Co. reported that its subsidiary, Jackson County Iron Co., owns a deposit of low-grade, iron-bearing material in the State of Wisconsin. Such preliminary laboratory work as has been done indicates that there might be produced about 7.4 million gross tons of concentrates, averaging 64-percent iron natural. The report to the Commission further stated that the investigations were carried out several years ago and would not provide an adequate basis for estimating costs or methods of operation.

Since the date of its report to the Commission, Inland has been active in strengthening its position with respect to domestic ore supplies. In 1950 it acquired a substantial participating interest in Morton Ore Co.[37] "The company continued its policy of adding to its iron-ore reserves in 1951 through the purchase of a 50-percent

[37] Cf. Inland Steel Co. Annual Report for 1950, pp. 9-10: "During the course of the year, negotiations were completed for leasing the company's South Eddy mine in Minnesota to Morton Ore Co. and in consideration thereof Inland acquired a substantial participating interest in that company. Morton Ore Co. also has under lease the Morton mine, which adjoins the South Eddy mine. These two properties will be operated jointly for the benefit of the stockholders of Morton Ore Co. under the management of M. A. Hanna Co. of Cleveland, Ohio. Development work is already under way, and it is expected that the production of iron ore will start in the fall of 1953." The "substantial participating interest" appears to be 40.5 percent of both the preferred and common stock (Listing Statements of the New York Stock Exchange, A-14190, Inland Steel Co., March 28, 1952, prospectus of March 5, 1952, p. 50).

stock interest in Pacific Isle Mining Co., which operates mines and concentrating plants on the Mesaba Range in Minnesota, and the execution of a long-term contract to purchase the entire production of this company. During the year steps were taken to increase the company's output of iron ore by opening a new mine * * * on lands leased on the Menominee Range in Michigan. This operation will be relatively small with a life expectancy of 5 years." [38]

Foreign holdings

Inland is vitally interested in the Steep Rock Lake project, which involves the development of iron-ore properties in the 7,000-acre tract held by Steep Rock Iron Mines, Ltd., in western Ontario, Canada.[39] During the period 1938–41, extensive surveys and diamond drilling established the existence of large high-grade hematite deposits under Steep Rock Lake. Three ore zones or ore bodies, termed "A," "B," and "C" as they were successively located, had been distinguished, and the outlines of the first two reasonably well defined.

"It became apparent early in the exploration of the property that the ore bodies were of sufficient extent to warrant open-pit mining operations. This in turn necessitated removal of the water from the 10-mile eastern portion of Steep Rock Lake. In order to do this, it was necessary * * * to move the Seine River 2 miles westward for 8 miles of its course, thus removing the river from the portion of Steep Rock Lake in which the ore bodies occur." [40]

For the accomplishment of these preliminary engineering exploits, considerably more capital was needed than Steep Rock Iron Mines had available; and in this predicament the company "enlisted the collaboration of Mr. Cyrus Eaton." [41] Six million shares of no-par-value stock were authorized; and Otis & Co., Cleveland, undertook the marketing of 5½-percent sinking-fund debentures, $2,250,000 of which were issued.[42] In addition the Reconstruction Finance Corporation also authorized a loan of $5,000,000.[43]

After this financing had been arranged, work on the Steep Rock properties proceeded rapidly. "Road construction was started in March of 1943, and the river diversion was complete in about 9 months. While this work was in progress the Ontario Hydro-Electric Power Commission built a line from Port Arthur to Steep Rock Lake. The Canadian National Railway built a spur line from Atikokan to the mine crusher and loading terminal, and the Dominion Government commenced construction of the ore docks at Port Arthur." [44] With power available, the pumping out of a portion of the lake was begun before the end of 1943.

During that year, "preproduction expenditures" amounted to more than $3.5 million, of which more than $3 million was devoted to river

[38] Inland Steel Co. Annual Report for 1951, p. 7.

[39] Moody's Manual (Industrials) has consistently reported the tract to be owned. Business Week, April 28, 1951, refers to it as "leased." Steep Rock Iron Mines, Ltd., was incorporated in the Province of Ontario on February 24, 1939. On April 18, 1939, it acquired all the assets of Steerola Exploration Co., Ltd.

[40] "Steep Rock Iron Mines, Ltd." (no pagination). This brochure, dated September 15, 1947, and apparently published by Steep Rock Iron Mines, Ltd., belongs to the category of promotional literature, but is largely historical and descriptive. It will be cited hereinafter as "Steep Rock brochure."

[41] Steep Rock brochure.

[42] Cf. Moody's Manual (Industrials), 1944, pp. 2111–2112: "Offered—($2,250,000) in March 1943 by Otis & Co., Cleveland, in units of $1,000 debenture and 200 shares of capital stock (v. t. c.) at $1,000 (United States dollars) per unit [proceeds to company ($900 United States dollars) per unit]."

[43] Cf. Moody's Manual (Industrials), 1943, p. 2513, where it was said that first-mortgage bonds would "be issued to the RFC after proceeds from sale of the debentures have been expended."

[44] Steep Rock Brochure. Reports that Steep Rock Iron Mines, Ltd., is receiving tax concessions from the Canadian Government appear to be borne out by the company's profit-and-loss statements.

diversion projects.[45] Exploratory drilling was continued to a limited extent. "After pumping had continued for some time, the removal of clay silt overburdened from over the 'B' orebody was started." Notwithstanding difficulties, development progressed. "Ore production began in May 1945, and during that shipping season 505,375 tons of ore were forwarded to eastern consumers." [46]

Also in 1945, Cyrus S. Eaton and William R. Daley, president and a director of Otis & Co., were named directors of Steep Rock Iron Mines, of whose board Eaton became chairman. Arrangements for the sale of the ore had been made some 2 years earlier. Moody's Manual (Industrials), 1943, reported: "On Jan. 15, 1943, Premium Iron Ores, Ltd., purchased 1,437,500 shares [47] (v. t. c.) or 26.8 percent of shares outstanding. The Cyrus S. Eaton interests [48] own over 90 percent of the stock of this company which was appointed sole sales agent for all ore produced by Steep Rock Iron Mines, Ltd." [49] Business Week, in a story on Steep Rock published in April 1951, stated that "By the terms of the stock deal, Premium was made exclusive sales agent for Steep Rock ores," and went on to say:

> Its fee was to be 2 percent of the value of the ore sold. There was a slight catch: Premium had no fleet to transport ore and no established customers. Both of these facilities were possessed, however, by Cleveland-Cliffs Iron Co., of which Eaton has long been a director and in which he and his associates hold large blocks of stock. So Premium made a deal with Cleveland-Cliffs to perform the sales and shipping chores. What Cleveland-Cliffs' share of Premium's fee will be has not been disclosed.[50]

In 1947 more than 1.2 million gross tons of ore were shipped, all from the open-pit mine in the "B" ore zone. As of May 1, 1947, "estimates of proven and probable ore reserves on the portions of the 'A' and 'B' zones that [had] been drilled" totaled more than 72 million gross tons. These reserves did "not include estimates of any ore expected to be developed by extension of the 'A' and 'B' zones in length or depth, or from other potential ore areas on the company's property." "The 'C' orebody [was] largely unexplored, and [was] not included in ore reserve calculations." [51] In its annual report for 1948, the company called attention to the fact that "Steep Rock ores are direct-shipping ores, used in furnaces directly as mined and as premium ores, in special demand by steel companies," and also stated that there were "known to be at least five * * * zones favorable to the occurrence of orebodies" in addition to zones "A" and "B," and declared to be "indicated an ore potential of several hundred million tons and the continuity of mining operations for

[45] Moody's Manual (Industrials), 1944, p. 2111.

[46] Steep Rock Brochure.

[47] Premium bought "these shares for $14,375, or 1 cent a share," according to Business Week, April 28, 1951 (p. 96), which reported "these 1 cent shares" to be "selling at $9 on the Toronto Stock Exchange" (the high for 1951, as reported in Moody's Manual (Industrials), 1952, p. 2855, was $11). Business Week appears to have been in error in speaking of the shares purchased by Premium as "$1 par stock." The stock was originally without par value; it was changed from no par to $1 par, share for share, in July 1943 (Moody's Manual (Industrials), 1944, p. 2112).

Cf. Moody's Manual (Industrials), 1951, p. 2825: "On March 26, 1949, Premium Iron Ores, Ltd., owned 705,886 shares or 10.8 percent of shares outstanding. The Cyrus S. Eaton interests own controlling stock interest of Premium Iron Ores, Ltd. * * *"

[48] At the time Premium bought its Steep Rock shares, Eaton was a director of Cliffs Corp., which owned all the common stock of Cleveland-Cliffs Iron Co. and also had stock interests in Republic, Inland, Wheeling, and Youngstown. He has been a director of Cleveland-Cliffs since the consolidation of Cliffs Corp. and Cleveland-Cliffs in 1947.

[49] Op. cit., p. 2514.

[50] Op. cit., April 28, 1951 (Underwater Iron Mine Pans Out), p. 96. When "an output of about 1,200,000 tons" of ore was expected in 1947, it was estimated that lake steamship companies would "collect * * * $1,400,000" (Steep Rock Brochure). There was a report in 1949 that Cleveland-Cliffs receives discounts on purchases of ore from Steep Rock Iron Mines and, in addition, a fee and expenses as a consultant adviser on the operation and management of the mines.

[51] Steep Rock Brochure.

many years at rates as high as 10,000,000 tons annually." [52] But before these optimistic views regarding Steep Rock's prospects came to formal and official expression in an annual report,[53] the Export-Import Bank had made $5,000,000 available for expansion, and the company had been able to dispose of a $2,000,000 issue of preferred stock and also of additional common.[54]

During 1949 Steep Rock was much occupied with preparations for removal of the overburden on the "A" ore zone, largely a matter of dredging, for which considerable capital equipment had to be acquired and assembled. The company's annual report for that year reported "steady progress * * * being made in the engineering and physical development of the underground workings of the Errington Mine" (zone "B"). "Underground output," it was said, "will initially supplement and ultimately supersede present open-pit production from the Errington Mine, and planned mechanization of underground operations is designed to result in operating costs no higher than those of open-pit mining.[55]

Late in 1949, Steep Rock Iron Mines and Inland Steel made the agreement, presently to be discussed, by which Inland became a prospective participant in the exploitation of the reserves of the Steep Rock region. Development activities on both the "A" and "B" ore zones were pushed forward steadily during 1950 and 1951. Toward the end of the former year, an agreement similar to that made with Inland was entered into with a group headed by Pickands Mather, which obtained an option on a tract adjacent to the "C" ore zone being explored by Inland.[56]

In the area retained by Steep Rock Iron Mines for its own use (about two-thirds of the company's holdings), development is so well advanced that production, both from the open-pit mine to be put into operation on the "A" zone and from the new underground mine on the "B" zone, is expected to begin by 1953. "Important results" were considered to "have been achieved from exploration activities during" 1951. These activities appear to have been concentrated mainly upon "a geologically favourable section 6,000 feet long, presently called the G zone," which lies between zones "A" and "B." Exploration of this zone was to continue, according to the company's annual report for 1951, which, regarding the latest plans for exploration and conclusions based upon exploration recently completed, said further:

> Geophysical surveys of the same type used successfully in the location of the first two Steep Rock mines have indicated the desirability of diamond-drill exploration in other geologically favourable areas of the company's property.
>
> It has become increasingly evident that the several iron-ore deposits on Steep Rock properties are extensive in area and that they are likely to persist to great depth. Considerable exploration remains to be done before the total available ore tonnage can be known, but exploration results on four orebodies and favourable geological prospects elsewhere on the property lead to the expectation of an ore potential of as much as 500,000,000 tons per 1,000 feet of depth.[57]

[52] It was stated further that plans for expansion contemplated "annual production of these two mines [A and B] to be stabilized at a 4-million-ton rate from both open pit and underground mining."

[53] Annual report for 1948, dated September 2, 1949.

[54] Cf. idem.: "The additional capital for the expansion program was obtained from a $5,000,000 4½ percent first mortgage loan from Export-Import Bank, a United States Government agency, and from the private sale of $2,000,000 of 5 percent preferred stock, convertible into common stock at $3 per share, and 720,000 shares of additional common stock at $1.40 per share. Holders of the preferred stock were granted options, expiring in 1958, to purchase 333,332 shares of the company's common stock at $3 per share."

[55] Steep Rock Iron Mines Ltd., annual report for 1949.

[56] Steep Rock Iron Mines Ltd., annual report for 1950.

[57] Op. cit.

It is in the context of the Steep Rock area's prospects, and of the problems that were encountered by its developers, that the significance of the Inland lease should be judged.

In its annual report for 1949 (dated April 6, 1950), Steep Rock Iron Mines, Ltd., informed its shareholders as follows:

> In line with your company's program to achieve the most rapid development of its full resources with minimum capital expenditures, we have entered into an agreement with Inland Steel Co. of Chicago, * * * whereby Inland has undertaken to explore, under an option to lease and develop, our "C" ore zone, one of the several remaining undeveloped ore areas on the Steep Rock property. During the past winter, Inland has conducted an aggressive exploratory drilling program, the results of which have been highly satisfactory.[58]

The option is exercisable on or before December 31, 1953. Inland's operations were conducted by Caland Ore Co., Ltd., a wholly owned subsidiary, organized in 1949 and incorporated in the Province of Ontario.[59] Approximately a year later than Steep Rock's announcement quoted above, Inland stated: "In view of the fact that exploration is being conducted over a very large area, it is impossible to interpret as yet the results to date. Continuance of the current drilling program for 2 more years will be necessary before information is available as to the type and size of the ore body." [60]

Regarding the property Inland has under option, a company official informed the Commission in April 1951, that Inland has rights to 100 million tons of iron ore in the Steep Rock region and that when the company exercises the option to take the lease, the lease will contain a firm commitment on Inland's part to develop a producing mine. It was also stated that the company hoped that shipments would start about 1956. Canadian National Railways, the Commission was told, is willing to construct facilities necessary to the transportation of ore from the mines to Port Arthur on Lake Superior. Inland has used some Steep Rock ore, which was purchased from Cleveland-Cliffs.[61]

Under the heading "Future outlook," Steep Rock Iron Mines' annual report for 1951 (dated March 25, 1952) devoted the following paragraph to Inland:

> It is expected that the "C" ore zone optioned to Inland Steel Co. on a royalty basis will be under active development in 1953. The June, 1951, issue of "Inland News," published by Inland Steel Co., had this to say of the C ore zone: "The knowledge that we have already acquired about the nature of the orebody is still incomplete, but the results indicate that Inland may have one of the richest deposits in the area."

Inland, however, wrote more cautiously in reporting to its stockholders on the activities of 1951 in the Steep Rock area:

> A second winter's exploration program was completed on the optioned lands at Steep Rock Lake. * * * The scout drilling program started the previous winter was continued and, in addition, many deep holes were drilled to further outline and define the extent of any indicated ore bodies. No drilling program was planned for the winter of 1951–1952 as the previous years' results are being studied to determine what further exploration work is required.[62]

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[58] Cf. Inland Steel Co., annual report for 1949 (March 31, 1950), p. 10: "In December 1949, negotiations were completed with Steep Rock Iron Mines, Ltd., of Toronto, Canada, whereby the company has taken an option to lease a large acreage in the vicinity of Steep Rock Lake in western Ontario. Exploration of the optioned property by diamond drilling is under way." The exact extent of the acreage seems never to have been stated either by Steep Rock or by Inland. Business Week, April 28, 1951, p. 94, reported the "C" ore zone as consisting of 800 acres.

[59] Listing Statements of the New York Stock Exchange, A–14190, Inland Steel Co., March 28, 1952, prospectus of March 5, 1952, p. 8.

[60] Inland Steel Co., annual report for 1950, p. 9.

[61] Report, dated April 17, 1951, of an FTC attorney-examiner's interview with Inland officials. That Steep Rock Iron Mines, Ltd., and Cleveland-Cliffs Iron Co. have a common director in the person of Cyrus S. Eaton has already been noted. Edward E. Brown is a director of both Inland Steel Co. and Cleveland-Cliffs Iron Co.

[62] Inland Steel Co., annual report for 1951 (dated March 28, 1952), p. 7.

The prospectus accompanying an Inland listing application having the same date as the annual report containing the passage just quoted was even less definite concerning the possibility of the company's engaging in mining operations in the Steep Rock area. After reciting certain facts relating to the history and terms of Inland's option, the prospectus said:

> If Caland Ore Company, Limited, should exercise its option and enter into a mining lease, substantial drainage and other operations will be required before a mine can be developed. Caland Ore Company, Limited, has carried on exploration under the agreement. However, at this time the company is unable to express any opinion as to the probability of an operation in the area explored." [63]

Whether or not Inland will exercise its option thus seems at least somewhat problematical.

Competitive position

Inland's production facilities at Indiana Harbor, Ind., have been depending on Lake Superior ore except for relatively small Canadian imports. In 1948 the company received over 2.9 million tons—not quite two-thirds of its requirements for that year—from its sundry mining interests in the district.

At the production level of 1948 the company appears to have enough open-pit direct-shipping ore to supply its needs until approximately 1955. If tonnages that were reported as "indicated" and "inferred" are added, however, its reserves of this low-cost ore should not be exhausted until the end of the decade. The company's underground reserves are substantial, and production from these deposits may, in a few years, take the place of that from the less costly ore. Recent acquisitions obviously have strengthened Inland's position but it is impossible to estimate to what extent they have done so.

Once production from the company's Steep Rock properties begins—assuming that Inland exercises its option and takes a lease—imports from this source should solve Inland's iron ore problems for years to come. However, no definite word is available as to when and under what conditions development of these reserves is contemplated, or, indeed, whether Inland will undertake their development at all.

Purchase contracts with several ore merchants [64] guarantee the company delivery of quantities up to 800,000 tons a year through the year 1953, and 550,000 tons for the year 1954. No report was made to the Commission of any contracts between Inland and sellers of ore extending beyond the year 1954.[65] The big unknowns in the solution of Inland's future raw material supply problems thus appear to be the timing and size of the shipments from Steep Rock mines and the expansion of production from its underground direct-shipping reserves.

ARMCO STEEL CORP.

Domestic reserves

Armco had at the beginning of 1949 about 21 million tons of ore reserves in the Lake Superior and western districts. The company's interests in Lake Superior are represented by fractional ownership of companies managed by Hanna and Oglebay, Norton.

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[63] Listing Statements of the New York Stock Exchange, A-14190, Inland Steel Co., March 28, 1952, prospectus of March 5, 1952, p. 8.

[64] Butler Bros., Cleveland-Cliffs, and Hanna Coal & Ore.

[65] How much ore Inland can hope to obtain in consequence of its long-term contract (made in 1951) for the full production of Pacific Isle Mining Co. is unknown. Cf. pp. 122–123.

On the basis of its 15-percent ownership interest in Hanna Ore Mining's reserves, Armco's share was 6.2 million tons. Of this amount, approximately 4.7 million tons were direct-shipping ore, with most of it located underground. The remaining 1.5 million tons were of concentrating grade, the larger portion of which was in open-pit mines. Through apportioning of Butler Bros.' reserves (in which it is interested by virtue of its stock ownership in Consumers Ore Co.) the steel company was entitled to 7 million tons of ore. Most of this tonnage was concentrating-grade ore in open-pit mines.

Armco has a 25-percent interest in St. James Mining Co., managed by Oglebay, Norton. This entitled it to approximately 1 million tons of ore, all of direct-shipping grade from open-pit operations.

In July 1950, Armco had a one-third interest (it now has a half interest) in Reserve Mining Co., which controls deposits of magnetic taconite at the eastern end of the Mesabi Range. Its reserves as of January 1, 1949, were reported by Oglebay, Norton, managing agent, as amounting to 1,440 million tons of crude ore having an average magnetic iron content of 23.13 percent. The product obtained by beneficiation would have a natural iron content of upwards of 60 percent.[66]

In the western district Armco's wholly owned subsidiary, Sheffield Steel Corp., reported reserves of 6.9 million tons in the State of Texas. Although no breakdown by type of ore was reported by the mining company, ores in this area are generally open-pit of concentrating grade.

TABLE 11.—*Domestic reserves of Armco Steel Corp. as of Jan. 1, 1949*

[In 1,000 gross tons]

Company and percent ownership	Total reserves	Direct-shipping		Concentrating	
		Open-pit	Underground	Open-pit	Underground
Hanna Ore Mining Co. (15 percent)	6,250	815	3,923	952	560
Consumers Ore Co. (28 percent class A stock; 40 percent class B stock)	7,008	796	114	4,769	1,329
St. James Mining Co. (25 percent)	982	982			
Castile Mining Co. (25 percent) [1]					
Total	14,240	2,593	4,037	5,721	1,889
Sheffield Steel Corp. (100 percent) Texas properties [2]	6,886	(3)	(3)	(3)	(3)

[1] Castile Mining Co. is not a mutual company. Ore was purchased under contract; hence, reserves have not been allocated to Armco on the basis of its 25-percent ownership but have been left to the account of the managing agent, Oglebay, Norton. By 1949 Castile's reserves were approaching exhaustion.

[2] Although Armco did not file an iron-ore supply questionnaire with the FTC, Sheffield estimated 6,886,000 tons of recoverable ore owned in Texas. Ore in the Texas district is generally open-pit concentrating-grade ore.

[3] No break-down.

NOTE 1.—Armco has a 33⅓-percent ownership in Richmond Iron Co. 1 million tons of direct-shipping open-pit high-silicious ore allocated to Armco on the basis of its 33⅓-percent ownership.

NOTE 2.—Armco and Republic own 50 percent each in Reserve Mining Co., managed by Oglebay, Norton. Reserve Mining reported 1,440 million tons of potential ore of 23.13-percent iron content.

Foreign holdings

Armco is one of the steel companies with a stock interest in Iron Ore Co. of Canada, which is developing the Quebec-Labrador ore

[66] Cf. Armco Steel Corp., Annual Report for 1950, p. 16: "The property under lease by Reserve Mining Company is known to contain at least 1½ billion tons of magnetic taconite which can be mined by the low-cost open-pit method. When processed, this will yield about 500 million tons of high-grade iron ore. Geological studies also indicate the presence of substantial additional tonnages of taconite in the property." For further details concerning Reserve and its plans for taconite beneficiation on a commercial scale, cf. pp. 109–110.

deposits. By 1957 or 1958 Armco may have the right to purchase 1 million tons of this high-grade ore, assuming that the contemplated 10-million-ton annual production is achieved.[67]

Competitive position

Armco owns ore-smelting furnaces at three locations—Houston, Tex.; Ashland, Ky., and New Miami, Ohio. The furnaces at the latter two locations depend primarily on Lake Superior, the Houston plant on Texas, ore. Small tonnages from a variety of domestic and foreign sources have, in the past, supplemented the supply available for the Kentucky and Ohio plants, and a larger tonnage of Mexican ore has been a supplement for the Texas furnaces. The company's own Lake Superior interests apparently have been supplying only a minor portion [68] of its total receipts from this district.

With the exhaustion in 1950 of Castile Mining Co.'s reserves, Armco's remaining commercial ore interests in the Lake Superior district are represented by its part ownership in Hanna Ore Mining, Consumers Ore, and St. James Mining. In the past, Hanna Ore Mining has been the only one of these three companies which supplied Armco in proportion to its ownership interest.

If Armco's Kentucky and Ohio plants continue to depend mostly on purchased ore, the company may use its Lake Superior reserves for a considerable period of time. However, should the company be compelled to furnish from its own properties substantially all of its future requirements, even if these are assumed to be not in excess of 1948 levels, its Lake Superior open-pit reserves would be exhausted within a few years. By the end of this decade Quebec-Labrador ore is expected to relieve some of the pressure on the company's domestic resources.

Armco's expansion program is the most ambitious one, relative to present size, of any of the major steel producers. The company's steel-making furnaces will have almost 2.5 million tons of additional capacity in 1953. This represents a 73.5-percent increase in production facilities over 1948. The company's two units in the Pittsburgh-Youngstown area will absorb about one-half of this increase in steel capacity and simultaneously add to their blast-furnace capacity 500,000 tons.

In the past Armco has relied on contract arrangements to provide a substantial portion of its ore. In order to supply its increasing ore requirements, the company will have to exhaust its open-pit reserves by 1953 or 1954 unless it succeeds not only in renewing its contracts but also in having the quantities to be delivered under their terms considerably augmented.[69] Once shipments begin from Quebec-Labrador, they may make up for part of the company's rapidly dwindling domestic resources. These imports, however, can hardly decrease the company's dependence upon substantial deliveries from ore merchants. In the long run the company's interest in the Reserve Mining Co. should assure it of a share in that company's output of taconite concentrates. The production of commercial concentrates from taconites, however, is too remote to permit the inclusion of receipts from this source in the company's raw-material budget for the immediate future. Its small ownership of ore as well as its high

[67] Cf. pt. IV, National Steel Corp., pp. 117-120, for a discussion of the Quebec-Labrador project.
[68] In 1948, approximately one-fourth of the total receipts of 2 million tons.
[69] These contracts have been with Hanna Coal & Ore Corp. and Oliver Iron Mining Co.

degree of dependence on purchases, foreign ore, and taconites, make Armco's long-range supply outlook relatively precarious. Disappointment in its hopes for Labrador ore and taconite concentrates would have serious effects on the company's raw-material position.

Sheffield Steel Corp., of Kansas City, Mo., a subsidiary of Armco which operates the Houston plant, consumed over 400,000 tons of ore in 1948. All of the ore receipts of this plant from Texas, which represent about two-thirds of its total receipts, came from mineral-bearing lands in the State which are leased by the company. The remainder of its ore requirements was obtained from Mexico.

Armco's plans provide for almost tripling its steel-making capacity at the Houston plant. This increase, which will raise capacity to more than 1,000,000 tons in excess of that available in 1948, will be accounted for in large part by the construction of electric furnaces. The latter rely almost exclusively on scrap. The facts that the South is a traditional scrap-surplus area and that Sheffield probably has comparatively little competition in the area in its hunt for scrap should enable the company to rely on this raw material to a considerable extent.

Though most of the augmentation of steel output will have to be achieved by increased use of scrap, the additions to blast-furnace capacity will also enlarge the company's ore requirements to some extent. The company estimates that the ore reserves in its Texas leases are about 6.9 million tons of concentrates. It is doubtful that production from these properties can be sufficiently expanded to satisfy the increased requirements of the company. No information is available on Sheffield's contracts with Mexican ore producers. In all probability, however, the company will have to expand its purchases considerably in order to keep its blast furnaces operating at near-capacity levels.

WHEELING STEEL CORP.

Domestic reserves

All of this company's reserves are represented by investment interests in mining companies managed by others and located in the Lake Superior district. The total tonnage in these properties as of January 1, 1949, amounted to approximately 22 million tons. (See table 12.)

The entire quantity, with the exception of 2 million tons, was held by companies affiliated with Hanna. Wheeling owns 35 percent of the stock of Douglas Mining Co.; however, by agreement with Hanna Coal & Ore Corp., holder of the balance of the Douglas stock, Wheeling is entitled to 70 percent of the ore reserves held by this mining company. As of 1949, the tonnage due Wheeling amounted to 8.4 million tons. Approximately 6 million tons were direct-shipping ore, two-thirds of which was located in underground mines. The remaining 2.4 million tons were concentrating-grade ore, the larger proportion also requiring underground operations.

Wheeling's 15-percent interest in Hanna Ore Mining Co. entitled it to another 6.2 million tons of ore, over half of which was direct-shipping ore in underground mines. The 30 percent of the class B stock of Consumers Ore which is held by Wheeling added 5.2 million tons of the reserves of Butler Bros. (in which Consumers Ore is the

dominant interest)[70] to the company's reserves. This ore is largely of concentrating grade and can be obtained from open-pit operations.

Wheeling has a 15.2-percent interest in Mesaba-Cliffs Mining Co., managed by Cleveland-Cliffs. The reserves arising from this investment amounted to 2 million tons of open-pit ore of concentrating grade.

TABLE 12.—*Domestic reserves of Wheeling Steel Corp. as of Jan. 1, 1949*

[In 1,000 gross tons]

Company and percent ownership	Total reserves	Direct-shipping		Concentrating	
		Open-pit	Underground	Open-pit	Underground
Douglas Mining Co. (entitled to 70 percent of reserves)	8,392	2,031	3,958	966	1,437
Consumers Ore Co. (30 percent class B stock)	5,256	597	86	3,576	997
Mesaba-Cliffs Mining Co. (15.2 percent)	1,996	24		1,972	
Hanna Ore Mining Co. (15 percent)	6,250	815	3,923	952	560
Castile Mining Co. (37½ percent) [1]					
Total (all Lake Superior)	21,894	3,467	7,967	7,466	2,994

[1] Castile Mining Co. is not a "mutual" company. Ore was purchased under contract by Wheeling Steel. Hence, reserves have not been allocated to Wheeling on the basis of its 37½-percent ownership but have been left to the account of the managing agent, Oglebay, Norton & Co. By 1949, Castile's reserves were approaching exhaustion.

NOTE 1.—Wacootah mine reserves were exhausted in 1951.
NOTE 2.—Wheeling's interest in St. James Mining Co. was sold in 1950.

Foreign holdings

Wheeling Steel Corp. is one of the five steel companies sharing ownership in Iron Ore Co. of Canada.[71] Wheeling has the right to contract for the purchase, during the first 25 years of production, of a proportion of the annual production of Iron Ore Co. of Canada which is equal to its 8-percent stock interest. Hence, by 1957–58, the date when the maximum annual production is expected to be attained, Wheeling will be able to purchase 800,000 tons of this high-quality Canadian ore to supplement the production from domestic resources. As of December 31, 1951, Wheeling held 18.75 percent of the class B preferred stock of Steep Rock Iron Mines, Ltd.[72] While Steep Rock is evidently not a "mutual" company, Wheeling's status as a stockholder should not be disadvantageous in the event of its wishing to buy Steep Rock ore.[73]

Competitive position

Over 75 percent of Wheeling's 1948 ore receipts of 1.9 million tons originated with mining companies in which the company held ownership interests. Inasmuch as the company's ore receipts in that year

[70] Cf. p. 121 for a discussion of Consumers Ore and Butler Bros. Subsequent to the date in 1950 when the interests of steel companies in Consumers Ore were reported to the Commission, Wheeling acquired a 21-percent interest in the class "A" stock of that company (Listing Statements of the New York Stock Exchange, A–13782, Wheeling Steel Corp., April 26, 1951, prospectus of April 26, 1951, p. 44).

[71] Cf. pt. IV, National Steel Corp., pp. 117–120 for a discussion of the Quebec-Labrador development.

[72] Listing Statements of the New York Stock Exchange, A–13782, Wheeling Steel Corp., April 26, 1951, prospectus of April 26, 1951, p. 44.

[73] In addition to its stock interest in Steep Rock, Wheeling has or has had other relationships with that company through Cleveland-Cliffs. On June 30, 1950, Cleveland-Cliffs owned 5.45 percent of the outstanding stock of Wheeling, and the two companies had a common director as they still have (Moody's Manual (Industrials), 1952, pp. 2082, 275). Cyrus S. Eaton, chairman of the board of directors of Steep Rock since 1945, is, and has been since the consolidation of Cliffs Corp. and Cleveland-Cliffs Iron Co. in 1947, a director of Cleveland-Cliffs. Cleveland-Cliffs is reported to transport ore for the Eaton-controlled Premium Iron Ores, Ltd., exclusive selling agent for Steep Rock Iron Mines, and to have been employed by Steep Rock in a consulting capacity.

were in excess of its requirements,[74] Wheeling was virtually self-sufficient.

Two of the company's sources of ore in prior years, the Castile Mining Co. and the Wacootah mine, were exhausted by 1951. The company's remaining reserve properties are represented by its percentage interests in four other Lake Superior mining companies. The company's reserves in the four companies are large enough to enable it to draw upon them for another 10 to 15 years at 1948 levels of production. Production of underground ore may eventually make up for any tonnage losses through the exhaustion of open-pit mines. The Quebec-Labrador ore in which Wheeling will share on the basis of its 8-percent interest in Iron Ore Co. of Canada is also expected to increase the company's raw material supply in a few years. Meanwhile, Steep Rock Iron Mines may realize its expectation of having two new mines in production by 1953.[75] The prospect of obtaining high-quality ore from that source would thus be considerably improved, and Wheeling could probably expect to be a favored customer.

On the basis of information obtained from certificates of necessity, Wheeling's steel-making capacity will be almost 40 percent higher in 1953 than it was in 1948. The steel-capacity increase of over half a million tons will be exceeded by the company's additions to blast-furnace capacity. However, the company may be able to avoid any serious ore-supply difficulties in spite of the resulting increase in its ore requirements.

If Butler Bros. starts shipping ore to Wheeling on the basis of the steel company's interest in its reserves, Wheeling may continue, for some time at least, to receive from 1 to 1.5 million tons from its domestic mining properties.[76] Moreover, Wheeling has several contracts with domestic producers for deliveries of from approximately one-quarter to more than one-half million tons. It appears that the ore to be delivered under these contractual arrangements may virtually eliminate the need to rely on the spot market until imports from Quebec-Labrador assume major proportions. The success or failure of the latter project will, of course, have an important bearing on Wheeling's supply situation over a long-run period.

SUMMARY

The preceding account of the ore reserves held by the nine largest steel companies shows clearly the dominant position occupied by United States Steel. In part this dominance arises from a strategic grip, held for decades, over this country's richest ore resources. In part it rests upon extensive and valuable ore reserves in Venezuela. It is also based upon the company's substantial share of domestic taconite ores, coupled with financial resources which enable the company to engage in developmental work for commercial use of this low-grade material. Thus United States Steel straddles the past, present, and future as the outstanding leader in the control of the essential raw material for steel making.

The size of United States Steel's open-pit, direct-shipping reserves in the Mesabi has enabled the company to operate without fear of inability to get cheap ore. In contrast, the other eight companies,

[74] The Steubenville Works increased their stocks of iron ore by over 400,000 tons in 1948.
[75] Steep Rock Iron Mines, Ltd., Annual Report for 1951.
[76] Wheeling, as a part owner of Consumers Ore, is entitled to a portion of Butler's mine production.

also relying heavily on their open-pit, direct-shipping ore, have used their reserves at the risk of exhausting them and consequently will be compelled to shift soon to higher cost ore. The accompanying table shows that United States Steel produced 73.2 percent of the open-pit, direct-shipping ore reported by the nine steel companies for the Lake Superior district in 1948. In 1949 it still owned 85.5 percent of the reserves of this type of ore reported by all nine companies. On the other hand, the eight other companies accounted for 26.8 percent of the open-pit, direct-shipping ore produced in that district in 1948, but held only 14.5 percent of the reserves in 1949.

United States Steel's total reserves of all types in the Lake Superior district amounted to 585.6 million tons in 1949, of which 69 percent constituted open-pit, direct-shipping ore. Approximately 83 percent of its 1948 production was of this type of ore. The eight other companies, however, held only 358.5 million tons of iron-ore reserves of all kinds, of which 19.1 percent was open-pit, direct-shipping ore. Yet in 1948 approximately 44 percent of their production was ore of this type. Thus it is clear that United States Steel is using up its low-cost reserves at a much slower rate than its principal competitors.

TABLE 13

Percentage of ownership [1] of, and production [2] from iron-ore reserves of all types and of open-pit, direct-shipping grade reported by United States Steel and its 8 leading competitors in the Great Lakes district

[In thousands of gross tons]

	Reserves				Production			
	Total	Percent of total	Open-pit	Percent of total	Total	Percent of total	Open-pit	Percent of total
United States Steel Corp	585,678	62	404,127	85.5	34,710	59	28,885	73.2
8 leading competitors	358,571	38	68,583	14.5	24,100	41	10,573	26.8
Total 9 companies	944,249	100	472,710	100.0	58,810	100	39,458	100.0

Ownership [1] of, and production [2] from, open-pit, direct-shipping grade, and other types of iron-ore reserves as percentage of total Great Lakes ownership and production of United States Steel and its 8 leading competitors

[In thousands of gross tons]

	Reserves			Production		
	Total	Open-pit, direct-shipping	Percent of total [3]	Total	Open-pit, direct-shipping	Percent of total [4]
8 leading competitors	358,571	68,583	19.1	24,100	10,573	43.9
United States Steel Corp	585,678	404,127	69.0	34,710	28,885	83.2

[1] As of 1949.
[2] 1948 data.
[3] Reserves of open-pit, direct-shipping ore as a percent of total reserves.
[4] Production of open-pit, direct-shipping ore as a percent of total production.

Even in 1948 the eight other steel companies were forced to rely heavily on higher-cost ore. An examination of the ore reserves of the individual companies, other than United States Steel, shows that this trend will become more pronounced in the next few years. Even

a company like National, whose president testified before a Congressional committee [77] that it was more advantageously situated with respect to ore than any of its competitors except United States Steel, has little alternative. Of its 91.1 million tons of reserves, all in the Lake Superior district, only 8.3 million tons were open-pit, direct-shipping ore.

The domestic reserve positions of Bethlehem and Republic contrast sharply with the situation of United States Steel. Of Bethlehem's 65.3 million tons of reserves in the Lake Superior district, only 21.2 million tons were open-pit, direct-shipping ore. None of its reserves in Pennsylvania, amounting to 33.2 million tons, could provide ore of this type. Republic was in an even worse situation. Of its 13.8 million tons of reserves in the Lake Superior area, only 3.9 million tons were open-pit, direct-shipping ore. None of its reserve tonnage in New York and Alabama, totaling 50 million tons, was ore of this quality. Yet United States Steel had 404.1 million tons of open-pit, direct-shipping ore reserves in Lake Superior alone, and another 41.4 million tons in Utah.

The remaining five steel companies are also in a disadvantageous position. Youngstown Sheet & Tube, with all its reserve tonnage in the Lake Superior district, had 13.4 million tons of open-pit, direct-shipping ore out of its total of 46.7 million tons. Jones & Laughlin has relatively heavy reserves for a company of its size, but only 9.3 million tons out of its 56 million tons in the Lake Superior area were ores of the best quality. The 51.3 million tons of reserves in its New York properties were only of concentrating grade.

Inland had only 6.3 million tons of open-pit, direct-shipping ore in its total reserves of approximately 50 million tons in the Lake Superior district. Wheeling and Armco had about 3 million tons of such ore in their Lake Superior reserves, amounting to 21.8 million tons and 14.2 million tons respectively. Thus, even the smaller companies that are well situated with respect to ownership of reserves, such as Jones & Laughlin, Inland, and Wheeling, cannot escape the necessity of shifting soon to mining operations involving higher costs of raw material. The same is true of National, which is virtually self-sufficient and whose close ties with one of the ore merchants give it a special position.

In the long run, the ability of the steel companies to satisfy their requirements for ore will depend upon whether or not, and in what quantities, they succeed in importing iron ore from the new projects in Venezuela and Labrador and at Steep Rock Lake. At this stage it is difficult to predict to what extent the optimistic views of the industry, reflected in trade journals and speeches, will be borne out in experience. Some of the construction and cost problems which have to be met before the expected flow of ore can materialize have been indicated in the preceding pages. Failures to produce on schedule are possible in view of the magnitude of these problems.

But even if the most optimistic forecasts were to become reality, the effect would be the maintenance of the general pattern of concentration in ore ownership and control which now exists. As indicated earlier, United States Steel occupies the most favorable position in foreign ore. Its reserves in the Cerro Bolivar deposits in Venezuela constitute some of the highest-grade ore known anywhere on the

[77] Celler committee hearings, Ser. No. 14, pt. 4a ("Steel"), p. 812.

globe. With the completion of exploration and drilling, those reserves may be found to amount to one billion gross tons. This reserve is larger than that of any other company or any group of companies associated in the new foreign ore projects. After the construction of necessary facilities, the magnitude of ore shipments from United States Steel's holdings abroad will largely be determined by company policy.

In the past most of United States Steel's major competitors have been dependent upon Oliver Iron Mining Co., the company's ore-mining subsidiary in the Lake Superior district, for a portion of their ore supply. This dependence upon United States Steel will not change with the impending shift to foreign ore sources. If the Venezuelan ore from United States Steel's holding moves at the volume anticipated, most of the country's ore users will be dependent, at least in part, upon United States Steel—furnishing ore from either Oliver or the Venezuelan subsidiary, or from both sources.

In taconite beneficiation, the predominant position of United States Steel cannot easily be threatened. It has the largest holdings of any of the steel companies. For most companies, the size of the investment required even for research and pilot-plant operations, to say nothing of commercial exploitation of these low-grade ores, is a serious problem. No ore consumer in the country appears to be as advantageously situated as United States Steel to assume this financial burden. In fact, all of the other companies which have interests in taconite developments are associated with others in these ventures. Cooperative endeavor appears to be a matter of necessity if smaller steel companies are to get an opportunity to participate in the exploitation of these resources.

In the incessant struggle for ore supplies, the open market is virtually absent. At one time the ore merchants served a basic function in the steel industry; they brought ore to the open market and sold it to the highest bidder. Today their role is essentially that of managing agents for mining properties held jointly by the big steel companies. Most of the residual ore which remains after distribution on the basis of ownership ties is committed in long-term contracts well in advance of production. Much of this contracted ore goes to the nine major and a few of the smaller integrated steel companies. The spot market is a thing of the past.

PART V

NEW TECHNOLOGIES AND COMPETITIVE POTENTIALITIES

For the reasons which have been described in the previous parts of this report, the shift to substantial reliance on foreign ores and taconites may be expected to maintain, if not increase, the existing concentration of economic power within the steel industry. At one end of the scale, the position of United States Steel vis-à-vis all other steel producers will probably not be weakened. At the other end, most of the distinctly small producers will probably become even more dependent on their competitors for supplies, if indeed they are able to obtain them at all. In the middle of the scale, i. e., among the nine largest steel companies other than United States Steel, some of the companies may improve their standing somewhat, while others may suffer a loss in position, depending largely upon the long-range success or failure of their respective foreign ventures. Thus, it is unlikely that the present state of competition in the steel industry would be improved by a policy of relying almost exclusively on foreign ores and taconites to replace the dwindling Mesabi reserves of high-grade ore.

It is possible, however, that the forces making for the maintenance of the status quo may be partially offset by new iron- and steel-making technologies which may alter the present pattern of production.

The outstanding characteristic of present iron and steel technology is the large scale of operations required for profitable production. This dominant economic feature has, in turn, strongly influenced the location of the steel industry with respect to both markets and raw materials. In regard to the former, it has meant that the industry came to be located (freightwise) near consuming markets which are able to absorb the great output of the large productive units. In regard to the latter, it has meant that the industry came to be located (freightwise) near—and to be dependent upon—extensive bodies of raw materials which are adequate to feed the huge industrial appetite of the big mills. Large mills, near mass markets, favorably located with respect to extensive deposits of iron ore and coking coal—that is the pattern of the iron and steel industry of today.

Almost without exception, these new technologies appear to be of a "capital-saving" or "decentralizing" character. That is to say, they would, if successful, make possible profitable operations with a lower capital investment. Mills would be smaller; equipment less costly; and the total investment per unit of product less than under present technology. The effect of these technological developments on the location of the steel industry with respect to markets and raw materials would be the reverse of the present technology. Since their output would be smaller, the new productive units could be located near smaller markets, whose demand for steel might not be sufficient to support the large-scale mills of present-day technology. Similarly, they could be located near smaller bodies of raw materials, which, though rich in content, might not be sufficiently extensive to feed the big mills of today.

Some of these new technological developments relate to the utilization of ores, others to the process of steel making, and still others to the further stage of steel processing. Some would permit small units to operate with reasonable efficiency, utilizing local supplies of scrap in addition to other metallics. In general, they would permit additional capacity to be provided with smaller investment to exploit smaller ore deposits, or to serve directly more limited markets.

It is in these latter connections that the new technologies are of particular importance to the subject of this report. It so happens that there are scattered throughout much of the country small bodies of iron ore, which, because of their limited size, have never attracted the attention of the steel industry. For the most part, they are too small to permit profitable operations under existing technology. But while they are too small for the technology of the present, they may not be too small for the technology of the future. What was thus once an unexploited resource may come to be an important increment to our iron-ore supply.

Moreover, there are many bodies of ore which have never been utilized because of their distance from supplies of coking coal. Here again, the new technologies may prove to be significant, since some of them would appear to make possible the production of steel without the use of coking coal.

Thus, in addition to offsetting to some extent the forces making for greater concentration in the steel industry, these new technologies may, in effect, open up an additional source of iron ore—the small bodies of domestic ore which have not been used under existing technologies.[1]

These developments are to be found in each of the three major stages of the industry—iron smelting, steel making, and steel processing. Before describing these new technologies there will be presented a brief description of present, or conventional, processes in each of these stages.

Iron smelting

Iron ore is a mixture of various chemical compounds, of which the most important is iron oxide. Nearly all of the iron smelting in this country is done by the blast furnace, which is a huge chemical retort whose purpose is to remove the oxygen and such other impurities in the iron ore as can be removed through smelting. Sulfur, phosphorus, silicon, are most important among these other impurities. Lime acts as a flux combining with many of the impurities to form a slag which, in molten state, separates from the iron by gravity and is removed. The carbon in the coke combines with the oxygen from the ore and the air to form a gas, carbon monoxide, which is a valuable fuel, providing all the heat and energy required to operate the blast furnace and a substantial surplus for the generation of electric power for other than blast furnace uses.

A blast furnace includes the "stack," the "stoves" for heating the great volume of air required to provide the "blast," blowing engines to compress the air, dust catchers, scrubbers for the gas, and other

[1] Other gains result from the introduction of these technologies. If successfully applied, such technological innovations should further the geographic decentralization of the iron and steel industry, affording greater security against destruction in event of war. Important conservation gains are inherent in these changes—utilization of hitherto uneconomic ore reserves, reduction in coke requirements, and greater incentives to collect and utilize scrap. Important savings in transportation costs and lower production costs might also be expected.

accessories. The materials, or "burden," are transported from the storage bins to the top of the stack and dumped into the double-bell-and-hopper arrangement which prevents the furnace gases from escaping into the air. A modern stack of, say, 1,200 tons daily pig-iron capacity will be over 100 feet high, with maximum diameter of about 30 feet, and will have three to four stoves, each over 100 feet high.[2]

In this initial stage of iron smelting, the principal new technological developments appear to be the direct or low temperature reduction of ore (including the sponge-iron process), the Krupp-Renn process, and the electric smelting furnace process.

Direct or low temperature reduction of iron ore.—The European industry has long experimented with processes for producing pig iron directly without following the blast furnace route. Some of these direct iron processes are properly described as "sponge iron"; others carry the iron above the melting point of the metal. Significant quantities of high quality steel have been produced in Sweden from iron made by these processes, and also in certain German plants. Some of the steels, when imported into the United States, are reported to have commanded premium prices.

In this country, the Bureau of Mines has carried on experimental work in the direct reduction of iron ore, and for a time operated a pilot plant in Wyoming. However, the operation was not carried to a conclusive stage. During World War II, Republic Steel Corp. built a plant with Government financing at Warren, Ohio, for the development of sponge iron as a substitute for scrap for use in electrical furnaces. The successful development of sponge-iron processing plants for the direct reduction of iron ore in this country would create the opportunity for small but economical units to exploit the many ore deposits which are too small to fit into the integrated operations of the large companies. These methods would also permit the making of metallics without the use of metallurgical coking coal. The establishment of such plants would not only enlarge the general supply of metallics, but would also add to the open-market supply, thus enabling semi-integrated steel companies to supplement the limited supplies of scrap upon which they are principally dependent.

The cost of such facilities is reported to be low, and the equipment simple. Their development would, therefore, economize the use of manpower and critical materials. Such plants, located near sources of iron-ore supplies, could produce for local markets or ship the refined metallics to larger industrial centers. The methods are particularly attractive where low-cost electrical energy, perhaps from hydroelectric developments, or surpluses of natural gas, are available.

R. S. Dean in Sponge Iron, a Progress Report,[3] reviewed various methods for producing iron by other than the high temperature blast furnace processes, concluding that:

> Emphasis is gradually being shifted to the metallurgy of sponge iron; that is, toward the study of the new technologies that can be evolved (*a*) for converting the various types of direct iron into wrought iron, steel, and other marketable ferrous products and (*b*) for recovering useful metal from the larger unused iron-ore deposits of the country.

[2] Important accessories at many furnaces are sintering plants, where fine material such as furnace dust and ore fines are agglomerated with a binding material to provide a satisfactory material for use in the furnace. Pig casting machines for merchant iron and necessary equipment for transporting hot metal to the steel furnaces of integrated plants are part of a blast furnace.

[3] United States Bureau of Mines, R. I., 3790, January 1945.

The Krupp-Renn crude-iron process.—During the 1930's Friedrich Krupp A. G. developed on a commercial basis a method of processing low-grade silicious iron ore. In this process ore is reduced in a rotary horizontal kiln to a crude iron in granular form, using the cheapest available fuel for heating.[4] It is essentially a beneficiation process, for the resulting iron has a high concentration of sulfur which does not permit its use in normal steel-making furnaces.

Both the Germans and the Japanese made use of the Krupp-Renn process during the war, the Japanese building 11 plants in Japan, Korea, and Manchuria, ranging in daily capacity from 36 metric tons to 432 metric tons.[5]

The principal importance of the Krupp-Renn process[6] for this country appears to lie in the processing of iron ores which cannot be handled by other methods; for example, it will permit the processing of nonmagnetic taconites without roasting. Indeed, the process appears to be adaptable to a wide variety of ores of different physical and chemical characteristics.[7] It also offers an opportunity for great savings in the use of metallurgical coke. And it could result in an iron which would substantially increase the capacity of blast furnaces if further reduction by that process is used. The one serious disadvantage from the standpoint of conventional open-hearth steel-making procedure is the presence of sulfur and phosphorus in the iron rather than in the slag, as in blast furnace smelting. However, solutions to this problem may appear, perhaps through the use of electric steel-making furnaces.

Electric smelting furnace process.—Electric furnace iron smelting has been developed in Europe over a period of some 40 years, mainly by Elektrokemisk A/S of Norway. The best known furnace is the Tysland-Hole. In this country the electric smelting furnace has been used only on an experimental basis. However, the Pittsburgh Lectromelt Furnace Corp., the largest manufacturer of electric furnaces in the United States, is now advocating the installation of electric smelting furnaces. Their economical use is dependent upon the availability of low-cost electric power. In such areas the electric smelting process may be reasonably competitive with the blast furnace. Moreover, the electric smelting furnace has the additional advantage of producing good quality pig iron without metallurgical coke; low-grade cokes are satisfactory. Uniformly low-silicon iron can be produced, an advantage in steel-making furnaces.

Other processes.—In addition, there are a number of other new processes relating to iron smelting. Thus, H. A. Brassert & Co., who have long been acknowledged specialists in iron and steel processes, have developed a process for the low temperature reduction of iron ore to metallic iron by the use of reducing gases. Brassert states that:

> Based on actual operating experience with our pilot furnace in Minneapolis, a baking furnace sufficiently large to produce * * * 100 tons of metallic iron (per day) will only have an internal area at the bottom of 15 square feet.

[4] The slag carries a certain amount of iron, which can be recovered by crushing and magnetic treatment, the iron fines then being mixed with new ore for reprocessing.

[5] The largest Japanese plant at Iwataki processed a limonitic clay with an analysis of iron 21 percent, silica 32 percent, alumina 13.5 percent, plus other impurities. The resulting product, with a nickel content of 0.6 percent and a chromium content of 0.9 percent, was used to make alloy steels in electric furnaces.

[6] The process is analyzed by P. E. Henry, C. F. Ramseyer and J. R. Miller in Steel, Mar. 12, 1931, pp. 92–98.

[7] It might also make possible an increase in the iron-carrying capacity of the Great Lakes ore fleet through a reduction of ore at the head of the Lakes; proposals have been made for the utilization of North Dakota lignite in the production of sponge iron from low-grade iron ores in Minnesota (Production of Sponge Iron: Gaseous Reduction of Iron Oxide Glomureles in a Shaft Furnace. U. S. Bureau of Mines, R. I. 4305, p. 2, July 1948).

The process is designed for the reduction of high-grade ore and for use in areas where coking coal is not available. It is considered by Brassert to be economically feasible in capacities of from 100 to 200 tons of iron daily.

A variant process of low-temperature reduction of ores in a low-shaft blast furnace is employed by the Kloeckner-Humboldt Deutz Co. in Germany, and described in Iron Age, January 11, 1951. In this Humboldt distillation process noncoking high volatile coals are combined with ore fines in briquettes. The charging is continuous instead of intermittent as in the conventional blast furnace. The advantages claimed are low capital cost of installation, use of materials which are not suitable for normal blast furnaces, such as ore fines, scale, and pickling wastes, use of noncoking coals, and low operating costs.

Comparative cost data.—A recent study for United Nations, World Iron Ore Resources and Their Utilization, has developed comparative figures of production and investment costs for pig-iron production based on the operations of (1) the standard blast furnace, (2) the Tysland-Hole electric smelting furnace, and (3) the Wiberg-Soderfors sponge iron furnace. Representative figures for costs under conditions prevailing in Canada are utilized in the analysis.

TABLE 14.—*Production costs and investment requirements of the standard blast furnace, electric smelting furnace, and sponge-iron furnace* [1]

Item	Blast furnace	Electric smelting furnace	Sponge-iron furnace
Plant and furnace capacity:			
Total yearly output (tons)	280,000	110,000	45,000
Number of furnaces	1	3	2
Daily output per furnace (tons)	800	100	64
Production costs per ton of iron: [2]			
Coke	[3] $9.35	[4] $5.12	[5] $3.60
Ore	[6] 14.50	[6] 14.50	[7] 20.75
Limestone at $2.25	.97	.88	.09
Electrodes at $134		1.80	.40
Power at 0.3 cent per kilowatt-hour		7.50	2.70
Cooling water at 0.003 cent per gallon	.42	.33	.06
Labor at $1.20 per hour	.94	2.19	2.52
Repairs and maintenance	.50	.95	1.65
Overhead and miscellaneous (including casting)	3.65	3.80	3.25
Production cost	30.33	37.07	35.02
Less credit at 25 cents per million B. t. u.	1.90	1.75	
Net production cost	28.43	35.32	35.02
Total investment (thousands): [8]			
Furnaces and auxiliary equipment	12,000	5,000	1,300
Buildings	2,000	1,000	400
Ore and material-handling equipment	2,000	1,000	300
Coke ovens	6,000		
Working capital (6 months)	4,000	2,000	750
Engineering and contingencies	2,000	750	250
Total	28,000	9,750	3,000
Investment per ton-year, total	100	89	67

[1] Tysland-Hole electric smelting furnace and Widberg-Soderfors sponge-iron furnace.
[2] Production cost estimates based on typical operating conditions, reflecting 1948 cost-of-production factors in Canada. Production costs do not include profits or fixed charges on investment.
[3] Coke made in own plant at $11.25 per ton: 0.83 ton.
[4] Purchased mixed coke (metallurgical coke at $16.50 per ton, fines at $8.25 per ton): 0.45 ton.
[5] Purchased coke at $16.50 per ton: 0.22 ton.
[6] 50-percent iron content at $7.25 per ton: 2 tons.
[7] 56-percent iron content at $11.50 per ton: 1.8 tons (selected lump Steep Rock ore).
[8] Investment costs are not intended to be exact nor to apply to any particular location. They are representative costs in Canada in 1948 and are intended only for purposes of comparison.

Source: Adapted from tables 1, 3, 4, and 5: P. E. Cavanagh, Methods for Reducing the Amount and Quality of Coke Used in Smelting Iron Ore (e).

As can be seen from the table, the fuel and energy requirements for the three methods are quite different. The blast furnace requires between 0.8 and 0.9 tons of metallurgical coke per ton of finished pig iron. The electric smelting furnace requires 0.45 tons of coke per ton of pig iron, and only half of this needs to be high quality metallurgical coke. The sponge-iron process requires only 0.2 tons of coke per ton of pig iron. Hence the electric-smelting furnace and sponge-iron furnace are particularly suited to conditions where good coking coal is expensive or unavailable.

The electric smelting furnace, however, requires a cheap source of electricity, as 2,500 kilowatt-hours are utilized per ton of pig iron. The sponge-iron furnace requires about 900 kilowatt-hours of electric energy per ton of pig iron produced. The electric-energy requirements of the blast furnace are negligible.

The aggregate fuel and energy costs for the three methods are $9.35 for the blast furnace, $14.42 for the electric furnace, and $6.70 for the sponge-iron furnace.[8]

The labor costs, assuming a wage of $1.20 per hour, amount to 94 cents per ton for the blast furnace, $2.19 per ton for the electric smelting furnace, and $2.52 per ton for the sponge-iron furnace; repairs and maintenance show similar differences.

Ore costs are assumed at $20.75 a ton for the sponge-iron furnace; and at $14.50 for the blast furnace and the electric smelting furnace. The higher cost of ore for the sponge-iron furnace is assumed only because that process utilizes the richest ore possible. Indeed, one of the advantages of the sponge-iron process is the possibility of using small rich bodies of ore.

The great advantage of the sponge-iron process and, to a lesser extent, of the electric smelting process is the relatively low investment cost—$67 per ton for sponge iron and $89 for electric smelting as compared with $100 for blast furnace. Assuming an earnings allowance on investment amounting to 10 percent, the investment cost per ton by the electric smelting process would be $1.10 less than for the blast furnace; the sponge-iron furnace's investment cost would be $3.30 per ton less than for the blast furnace.

These cost comparisons would suggest that the electric smelting furnace and the sponge-iron furnace may compete successfully with the blast furnace where there are local bodies of rich ore, particularly where these local bodies are not of sufficient size to support a large integrated steel operation, or where the market will not absorb the large output of 800 tons a day which the blast furnace would produce. The indicated daily outputs for economical operations for the electric smelting furnace and the sponge-iron furnace are only 100 and 64 tons, respectively.

The cost disadvantage of the electric smelting furnace and the sponge-iron furnace would be decreased with a reduction in the cost of labor or a reduction in the cost of electric energy The electric smelting furnace might obtain a further cost advantage in the fact that it could use ores now unmarketable to the large blast furnaces and that it could often be located close to these ore bodies. Rising interest rates of capital cost would also operate to decrease the cost

[8] It is assumed that the blast furnace can obtain coke at $11.25 per ton in its own coke ovens, whereas the electric-furnace process is charged coke at commercial prices of $16.50 per ton for metallurgical coke and $8.25 for coke fines. Charging coke to both processes at the same rate would reduce the cost advantage of the blast-furnace operation from $5 to $1.

advantage of the blast furnace; rising costs of coking coals would have the same effect. The availability of scrap and the resultant savings in transportation costs in the export of scrap from consuming areas and in import of finished steel would tend to affect the differential in favor of the blast furnace. But the most significant cost characteristic concerning the electric smelting furnace and the sponge-iron furnace is the very much smaller investment required for economical operations.

Steel making

Where high strength and malleability are required, smelted iron, or pig iron, must be further refined into steel. Steel differs chemically from pig iron in that it contains a very small percentage of silicon and normally has a much lower carbon content. The content of sulfur and phosphorus must be reduced to a very small fraction to produce a satisfactory steel. The types of iron ores used in this country, and the nature of the resultant pig iron, have brought about the general use of three principal methods of purifying pig iron to produce steel—the basic open-hearth process, the acid-Bessemer process, and the electric-furnace process.[9] Each method produces steel differing somewhat from that produced by the other methods.

By far the most important in this country is the basic open-hearth process. In 1950 open-hearth steel constituted approximately 89.2 percent of the total output of steel mills.

The open hearth is a great brick oven provided with the necessary refractory lining. It is heated by gas or other fuel, the flame from which passes over the top of the furnace charge or "burden." A heat requires 10 to 12 hours. Most open hearths today are rated at 100 tons or greater capacity, the trend being toward furnaces of from 200 to 500 tons capacity. Some increases in efficiency undoubtedly accompany the increase in capacity, but, for the most part, the open hearth of today is essentially the same as it was when first introduced into the United States around 1870.

In this second stage, steel making—which comes between iron making and steel processing—there are two important new technological developments. These are the turbohearth and the use of oxygen in the open hearth.

The turbohearth.—In early 1950 United States Steel Corp. announced the successful completion of a series of tests on a new type of furnace, known as a turbohearth, which may give rise to revolutionary changes in steel making. The potentialities of the turbohearth process are indicated in the announcement by United States Steel's subsidiary, Carnegie-Illinois Steel Corp., in conjunction with Battelle Memorial Institute, of Columbus, Ohio. The open-hearth furnace operating with conventional technologies requires approximately 12 hours from charging time to produce steel. The turbohearth is reported to be capable of making open-hearth quality steel in 12 minutes without

[9] It should be noted that the terms "acid" and "basic" refer to the types of furnace linings used and to their effects on the metallurgy of the steel-making process. "Acid" linings have a silica base; their use results in the removal of carbon, silica, and manganese from the iron, and since they are not so effective in removing phosphorus, they must be used with low-phosphorus pig. Bessemer-type furnaces in this country are of the acid type; "Bessemer ore" designates the low-phosphorus ores used for making pig iron in Bessemer furnaces. "Basic" furnaces are lined with basic materials—such as magnesite—and are used to remove phosphorus as well as the carbon, manganese, and silica. Basic furnaces also remove some sulfur but in general the presence of sulfur in the pig iron makes it unsatisfactory for use in the open-hearth furnace.

using external fuel.[10] Thus United States Steel stated that a 30-ton turbohearth will be capable of making more steel in a day than a standard 225-ton open-hearth furnace.[11]

The turbohearth appears to have more advantages than its speed. The turbohearth operates without external heat; the open hearth requires external heat. The turbohearth handles relatively small tonnages at a heat, perhaps 25 to 50 tons, whereas the open hearth takes 200 tons or more; thus the turbohearth is a more flexible process in handling special steels. It may appear to be an advantage or a disadvantage that the turbohearth can take only 10 percent of its charge in the form of scrap. However, this should not prove to be a limiting factor if it were located near small but adequate bodies of ore.

The turbohearth lends itself to steel-making operations of small volume. Where local supplies of scrap or metallics are available, remote from centers of integrated production, it may be more economic to melt the scrap in electric furnaces to supply the molten charge for the turbohearth than to incur the heavy freight costs of shipping scrap to the larger steel centers and shipping finished steel products back to the same area. The turbohearth may also be employed in steel production in association with open-hearth furnaces where scrap is not available.[12]

It is not possible to predict when the turbohearth may come into commercial use. The unresolved problems relate primarily to matters of design intended to prolong the life of the refractory lining. Commercially, the turbohearth may succeed or fail according to the rate at which the magnesite linings are exhausted. Further experimentation may turn in the direction of designs which do not attempt to contain excessive heat but rather prefer to waste heat by cooling than to incur the costs involved in excessive temperatures. Development plans are going forward, and it is anticipated that in the near future a first production unit, a flexible postpilot hearth of 12 tons capacity, will be ready for trial.

Oxygen impingement.—Various steel companies have experimented with the use of oxygen in large quantities in the open-hearth production of steel. Oxygen can be used in the open hearth in two ways. First, it may enrich the combustion air during the charge or melting

[10] The ancestry of the turbohearth traces back to the Bessemer converter, which was introduced in the 1850's the first pneumatic process for converting molten pig iron to steel. In the late 1870's there was developed in Europe the Thomas converter, using a suitable basic lining and being applicable to high-phosphorus ores. In bottom-blowing steel making, carbon is almost completely burned, but as it is not carried to a higher state of oxidation than to CO when in contact with liquid iron, only a small portion of its heat producing capacity is utilized. Hence in the acid process, silicon and manganese are the principal sources of heat, and they are quickly oxidized. However, in the basic process more heat is required because cold lime is added to flux the phosphorus; this heat is provided by manganese and phosphorus. But the basic pig iron in this country seldom contains phosphorus in excess of 0.5 percent, and hence the Thomas process has not been used here.

In 1891, the Torpenas converter, an acid-lined vessel for surface blowing with all of the tuyères above the liquid level, demonstrated that surface blowing produces much hotter blown metal. This result is obtained principally because the CO released by the carbon boil is burned to CO_2 above the bath, thus raising the temperature of the metal. The combustion of carbon to CO_2 produces 3½ times as much heat as when it is burned only to CO; however, some iron is also burned during the surface blowing. The United States Steel experiment undertook to test surface blowing of regular basic pig iron in a basic-lined hearth using burned lime to produce a basic slag.

[11] The turbohearth experiment was described by C. E. Sims, of Battelle Memorial Institute, and F. L. Toy, of Carnegie-Illinois, at the February 16, 1950, meeting of the American Institute of Mining and Metallurgical Engineers. In its structure, the turbohearth follows the general lines of the Bessemer converter; the lower section, or hearth chamber, is a cylinder with its axis horizontal, and the nose section is a truncated pyramid. The design provides a shallow bath, with the air blast traveling the long dimension of the bath surface, thereby giving the maximum opportunity for reaction. The unit is mounted over a pit containing a slag box and a ladle for receiving the finished metal.

[12] The turbohearth is recommended for use only with pig irons which are low in silicon in order to avoid destroying the lining of the hearth. United States Steel does not recommend the turbohearth for making high-carbon steels but only for making 0.20 to 0.30 percent carbon steels.

period, and second, it may serve as a bath reagent to increase the temperature and speed up the reactions during the refining period. In this second use important savings in time are realized, reducing the time of heats from 12 hours to between 6 and 7 hours.

Linde Air Products Co. and Republic Steel Corp. appear to have taken the lead in the application of oxygen to steel production. The most critical problem has been one of supplying oxygen in large quantity at low cost. Linde has constructed a tonnage oxygen plant at East Chicago producing oxygen of 90 percent purity at the rate of 4,800,000 cubic feet (200 tons) a day. Republic Steel, at its Cleveland plant, has permanent installations supplying oxygen to seven of its working open-hearth furnaces, the use of which, however, was suspended pending the construction of special smoke-control devices.

Steel companies that have had experience with the use of oxygen report savings varying from 25 to 50 percent. Wheeling Steel Corp. is reported to have increased production from 12.3 tons to 17.5 tons per hour by using 600 cubic feet of oxygen per ton.[13]

Oxygen techniques have been tried in other countries. In 1913, Belgium tried oxygen supercharging in blast furnaces. The Germans also tried it, achieving early increases in production approximating 12 percent. In 1942 Steel Co. of Canada found that oxygen permitted increases of 22 to 40 percent in output. And in 1948 the Russians were reported to be planning the introduction of oxygen operations throughout their steel industry.

By appreciably shortening the time required to make steel, the use of oxygen offers the possibility of substantial increases in production without comparable addition to the industry's investment. This same result can be achieved, though to a lesser extent, by supplying larger volumes of air to the open-hearth bath. While the speed-ups thus attained are not as great as those achieved with the use of oxygen the cost savings are nonetheless substantial.

Steel processing

The steel as produced in the furnaces—Bessemer, open-hearth, or electric—must still be handled and processed from liquid to solid form and in such shapes and dimensions as can be rolled to finished forms. Traditionally the steel has gone through three principal stages between tapping into the ladle and rolling into semifinished and finished forms; namely, filling or "teeming" the ingot molds and subsequent stripping when the steel has hardened, reheating of the ingots in the "soaking pits," and breakdown rolling of the ingots in massive "blooming mills" or "slabbing mills" to dimensions that can be handled by the finishing mills.

From the steel-making furnaces, the liquid metal is poured into ingot molds, which are cast-iron molds, slightly tapered to permit easy "stripping"; that is, easy withdrawal from the ingot after the metal has cooled and contracted. The ingot molds are of various sizes and shapes, a typical ingot weighing around 5 tons. The molds deteriorate with use; so, it is necessary to discard them after about 70 cycles of use. The discarded molds go back to the furnaces as scrap,

[13] Most of the oxygen used in open-hearth steel making has not been used in the flame but has been introduced by lance or jet for carbon reduction only.

but they constitute a substantial investment, and their replacement and care contribute appreciably to operating costs.[14]

The process of casting steel into ingots results in the loss and bad distribution of so much heat that the steel has to be brought up to uniform rolling temperature. In order to heat the ingots uniformly, they are placed, after cooling, in "soaking pits." The ingots, which may be partly molten inside of their solidified outer shell, remain in the high-temperature soaking pits until the temperatures are equalized throughout the ingot and brought up to proper rolling level—about 2,200° F. Here again extreme care is necessary to prevent damage to the steel. The soaking time may take from an hour or so up to 6 hours for a cold ingot. The soaking pit is very inefficient, less than 10 percent of the delivered heat being absorbed by the steel; it is costly and occupies much valuable space in a steel mill.

In the final phase of steel processing prior to actual rolling of the finished shapes and forms, the ingots, as they come from the soaking pits, are reduced to bloom size for later production of bars, structurals, and similar forms, or to slabs for rolling into sheet or strip. The blooming mill has the most rugged and difficult service of all the rolling mills; it is the most costly and the most expensive of all to operate, considering that it is an intermediate step in transforming liquid steel into forms that the finishing mills can handle. It may take 19 "passes" in a blooming mill to reduce an 18- by 21-inch ingot to a 4- by 6-inch bloom. Yet, with all the care that can be given to handling the steel in these intermediate processes, it is usually necessary to scarf or chip surface seams, spongy steel and other defects out of the crude-steel blooms or billets.

New technological developments in steel processing are designed to bypass the costly and wasteful operations of ingot pouring and cooling, reheating in soaking pits, and "passes" through the blooming mills. The processes which are designed to accomplish such a miracle of production are known as "continuous casting."

Continuous casting.—Continuous casting has been extensively employed for a number of years for the nonferrous metals—aluminum, brass, and copper. Recently experiments have been going forward with processes for the continuous casting of steel. The perfection of these processes would result in substantial economies in investment costs and possibly in operating costs as well. The saving in investment costs would arise from the elimination of the heavy ingot molds and stripping cranes, the soaking pits, and the blooming mills or slabbing mills. Two methods which give promise of success are the Junghans-Rossi process and the Republic Steel-Babcock & Wilcox (Williams) process.

The first Junghans-Rossi continuous casting machine was brought into this country in 1938 by Scovill Manufacturing Co. and applied to the casting of brass. This machine was built in Germany by Junghans, the inventor of the process. It was designed for the continuous casting of rounds, and it made possible a high rate of production which that company attained in the manufacture of brass shells

[14] The preparation of sound ingots is an important part of steel making, and in spite of the greatest care a large part of each ingot must be cropped to remove impurities and resulting blowholes that become concentrated at the center and top of the ingot. The croppings also return as scrap to the steel furnace.

during World War II.[15] In 1948, Scovill Manufacturing Co. purchased a second Junghans-Rossi machine, which is casting slabs continuously.[16]

Allegheny-Ludlum Steel Corp. is applying the Junghans-Rossi method of continuous casting to steel. At its Watervliet, N. Y., plant it has an experimental continuous casting operation in which some of the problems encountered in the continuous casting of steel are being resolved.

The distinctive feature of the Junghans-Rossi machine is the mold, which is reciprocating; that is, the mold moves downward as the casting descends and then returns to its former position, the speed of the return movement being three times as fast as the downward movement, and the amplitude of the fluctuation of the mold being approximately three-fourths inch. The reciprocating mold permits the molten metal to solidify while in contact with the cooling-mold wall, which is then freed from the casting by the return movement. The cooling is accomplished by the scouring action of water at high velocity moving through the mold.[17]

Casting speeds vary. Scovill Manufacturing Co. casts brass slabs at the rate of 17 to 20 inches a minute. It is reported that the present Junghans-Rossi machines will cast a slab of steel 3 inches by 15 inches at the rate of 30 inches per minute. This would permit casting steel at the rate of 11 tons per hour. The rate of casting is controlled by the rate at which the solidified slab is carried downward through pinch rolls located below the mold. However, Allegheny-Ludlum, employing a similar machine, is casting slabs 15 inches by 3 inches by 21 feet at the rate of 20 tons an hour.[18]

The experience of Allegheny-Ludlum yields the following estimates with respect to investment and performance for the Junghans-Rossi continuous casting process, as applied to steel.[19] Continuous casting can be carried on at the rate of 20 tons an hour. However, if allowance is made for down time, a rate of 18 tons an hour may be assumed. If it likewise be assumed that operations can be carried on 160 hours a week for a 50-week year, there would be 8,000 hours of operation.

[15] Bristol Brass Co. is using the Junghans-Rossi machine at its Indianapolis plant and also at Bridgeport Extruded Metals of Grand Rapids, Mich., employed a Junghans-Rossi machine for aluminum, but its use has been discontinued. American Metal Co., Ltd., at Carteret, N. J., is employing the process for the continuous casting of copper.

[16] Since Scovill Manufacturing Co. is operating a continuous casting machine which, with some modifications, promises to be usable in the casting of steel, it is worth while to examine Scovill's experience with the Junghans-Rossi continuous casting process in nonferrous metals. The Scovill plant has three Ajax-Scomet electric melting furnaces supplying molten brass for continuous casting. These furnaces, each having a capacity of 22,500 pounds, are tapped for 5,000 pounds of metal every half hour. The large capacity of the furnace aids in maintaining a uniform composition of the metal. In tapping, the molten brass is withdrawn from the bottom of the furnace and is carried by a ladle to a holding furnace with a reservoir capacity of 9,000 pounds mounted on top of the continuous casting machine. The temperature of the metal in the holding furnace is maintained by a built-in Ajax 120-kilowatt induction unit. This furnace, built on a tilting turntable, is equipped with two pouring downspouts located at opposite sides of the holding or reservoir furnace, thus permitting one to be withdrawn or repaired while the other is in use. The mold used with the Junghans-Rossi machine has either a round cross section or a slab cross section. Scovill employs both machines. The slab-casting machine casts slabs of approximately 2¼-inches thickness and having widths up to 20 inches. The slabs can be cut at any desired length.

[17] The flow of metal from the holding furnace is controlled by a needle valve in the top of the downspout which opens in response to the tilting of the furnace. Undermouring is used in withdrawing the molten metal from the holding furnace, and the inverted T downspout distributes the molten metal in the top of the mold below the surface of the metal in the mold. Gas burning across the top of the molten metal in the mold protects the surface from oxidizing, while sperm oil dropped into the mold head provides the small amount of lubrication employed in this process. Allegheny-Ludlum in its continuous casting employs a powdered lubricant, molybdenum sulfide.

[18] The descending brass slab is cut by a high-speed rotary saw which automatically clamps to the slab, performing the cutting while the slab is descending. Steel billets are similarly cut by an oxyacetylene torch. At Scovill's the cut slab or billet drops into a tilting basket which then delivers the hot slab or billet on a horizontal table from which rollers carry it forward to milling operations.

[19] The Allegheny-Ludlum continuous casting machine is casting slabs 15 inches wide by 3 inches thick at the rate of 20 tons an hour. A thin wall mold is used, the mold being 24 inches by 24 inches by 15 inches. The operation is similar to that described for Scovill Manufacturing Co., the mold being of a reciprocating type and being lubricated in this instance by powdered molybdenum sulfide.

At 18 tons an hour, this would yield an annual production of 144,000 tons a year. Thus, one machine, representing an investment cost of perhaps $200,000 and operated with a small crew, could cast nearly 150,000 tons of metal a year. A conventional large steel mill may produce from a million and a half to 6,000,000 tons of steel a year. If continuous casting should prove applicable to the entire range of steel, 10 to 40 continuous casting machines could handle the entire output at an investment cost of $2,000,000 to $8,000,000, a substantial saving compared to the investment cost incurred for ingot molds, stripping cranes, soaking pits and blooming or slabbing mills.

A new corporation, Continuous Metalcast Corp. of New York has been organized to take title to the American and Canadian rights to the Junghans and Dunross continuous-casting patents owned by Irving Rossi, of 40 Wall Street, New York. The stock interest in the new corporation was originally divided among Irving Rossi (45 percent), Allegheny-Ludlum Steel Corp. (35 percent), American Metal Co. (10 percent) and Scovill Manufacturing Co. (10 percent). Subsequently Koppers, Co., Inc., undertook to build the continuous-casting machines and bought a substantial interest in Continuous Metalcast Corp.

The Babcock & Wilcox continuous-casting machine has certain significant differences in design. The principal difference is in the mold, which is 6 feet long and nonreciprocating.[20] Babcock & Wilcox are employing a conventional melting furnace in what is essentially a pilot-plant operation, casting being continuous for each heat, with interruption coming between heats.[21]

Babcock & Wilcox has been casting a billet which is described as a "utility oval," 9 inches by 4¼ inches. Casting at the rate of 6 feet a minute gives an output at the rate of approximately 15 tons an hour. The company is also reported to be building a mold to cast billets having a cross section of 100 square inches; this would supply a casting suitable for rolling continuous sheet metal in widths up to 26 inches. With a mold of this size, continuous casting would become applicable to 25 to 30 percent of the steel industry's total tonnage.

The economies and advantages attainable with continuous casting may be summarized as follows:

1. Large savings in investment are achieved through the elimination of all equipment associated with pouring molten metal into ingot molds, stripping the ingots from the molds, soaking pits for reheating the ingots, and blooming and slabbing mills.

2. In addition to the savings in capital costs, the continuous casting process may result in economies in operating costs. The continuous casting operation at Scovill Manufacturing Co. is carried on with only two operators at one of the continuous casting machines and a third man on the ground floor where the cut slabs are delivered to conveyors. Two or three platform men tend the electric furnaces.

[20] The mold is made of brass (18–15) and has a wall of 0.235 inch thick. The mold wall is straight, the shrinkage of the cooling bar providing the necessary clearance between the mold and the casting. The mold is kept scrupulously free from grease by wiping with carbon tetrachloride. Cooling is accomplished by water racing down over the outer surface of the mold at high velocity at approximately 50 to 60 cubic feet per second. The water picks up only 10° of heat.

[21] The furnace, having a 5-ton rated capacity, is used at 7½ tons. The furnace is mounted on rails and tilts around a pouring lip.

The process does not use underpouring. The metal from the melting furnace is poured into a tundish, and in passing through the tundish the slag is separated. From the tundish the molten metal drops into the head of the mold, where a nonoxidizing atmosphere is maintained by introducing 2 ounces of castor oil and a small amount of argon, an inert gas, into the upper end of the mold, to exclude and absorb oxygen.

One crane operator brings the charge to the loading platforms of the furnaces and also carries ladles when the furnaces are tapped.

3. Continuous casting yields 97 to 98 percent of the metal cast. In contrast, casting into ingot molds yields only approximately 82 percent, the remaining parts of the ingot being cropped off as scrap.[22]

4. Better quality billets and more uniform composition of metal are secured with continuous casting.

SUMMARY

To summarize this description of new technological developments, it is clear that in the first stage of steel production, iron smelting, this country has lagged behind other nations in the development of the electric smelting furnace and the direct reduction smelting process (including sponge iron), despite the fact that rising labor costs, declining electricity costs and a growing scarcity of coking coals would appear to make these processes increasingly competitive with the blast furnace.

In the second stage, steel-making, any new technological development, such as the turbohearth, which would bring about a dramatic decrease in the time—and thus in the investment—required to produce a given amount of steel should constitute a powerful force for decentralization of the industry with respect to both geography and ownership. The increased use of oxygen or air should enable existing facilities to expand their output with relatively small additional capital costs.

In the third stage, steel processing, continuous casting may have revolutionary effects on the structure of the steel industry. Principally as a result of its elimination of the use of ingot molds, stripping cranes, soaking pits and blooming or slabbing mills, the new process is said to be economical for outputs of 100,000 tons a year—a striking contrast to the 1,000,000-ton output which is required to justify new capital investment with conventional processes. In addition to these great savings in capital investment, continuous casting may also effect economies in labor and other operating costs.

Thus far, the economies have been discussed in terms of those realizable by each of the new technical developments, considered independently. Even more dramatic results may be achieved if the new techniques can be integrated in the development of new and smaller plants. Using small iron ore reserves and local sources of scrap, such an integrated operation might begin with direct reduction or electric smelting to produce iron. This could then be converted to steel, perhaps in turbohearths or electric furnaces, the molten steel passing directly to continuous casting machines for castings in usable billets. A small integrated mill of this type should not be a great disadvantage in competition with the larger conventional mills, at least with respect to its immediate markets.

As with all new technologies, the question of whether these new developments live up to their apparent potentialities is, at best, a

[22] The continuously cast billets give rise to only 2 feet of scrap bar for each heat that is poured (not for each billet that is cut); some 4 to 6 inches are taken from the bottom of the first billet where the dummy bar is used to close the mold at the beginning of the pouring and 18 inches taken from the top of the last billet. The percentage of scrap remains constant regardless of the size of the heat when casting into ingots, but when continuous casting is employed, scrap is a diminishing percentage as the size of the heat increases.

matter of conjecture. The sponsors of a new technique are understandably reluctant to launch their process until it has been thoroughly tested.

Quite apart from technical considerations, there are other factors which would tend to hold back the introduction of new technologies. Thus, many of the "capital saving" techniques, as described above, are controlled by established leaders in the industry and decisions as to when they will be employed and the terms on which they will be licensed to others will be taken in the light of the competitive position of the owning corporations. It must be recognized that the general adoption of new technologies resulting in large savings in capital investment might have the effect of making present equipment obsolete. There will therefore be a strong incentive for the owning corporation to time its employment and licensing of the new technology to protect its existing investment in steel-making facilities. Indeed, if competitive pressure is insufficient, there is no assurance that even the full depreciation of existing facilities will be followed by the introduction of the new techniques.

The possibilities for delay are further aggravated by the fact that most of the different new technologies are owned by separate firms. Thus far, there has been little, if any, joint development work among the steel companies on technologies which might complement or supplement each other.

For all of these reasons, these new technologies, despite their promise, are far from being commercial realities. Under present circumstances, any widespread use of the hitherto unexploited small and scattered deposits of high-grade domestic ore, as an additional source of new ore supplementing foreign ores and taconites, can be expected to take place only in the indefinite future.

TABLE A–1.—*Annual shipments of iron ore in United States, 1911–49, exclusive of ore containing 5 percent or more of manganese and of ore sold for paint*

[In thousands of gross tons]

Year	Lake Superior		Alabama and Georgia		Missouri		New Jersey, New York, Pennsylvania		Utah		Wyoming		All other States		Total, United States	
	Quantity	Percent of total	Quantity	Percent of total	Quantity	Percent of total	Quantity	Percent of total	Quantity	Percent of total	Quantity	Percent of total	Quantity	Percent of total	Quantity	Percent of total
1911	32,903	80.1	4,163	10.1	73	0.2	1,933	4.7	35	0.1	(1)	-------	1,985	4.8	41,092	100.0
1912	48,199	84.5	4,912	8.6	42	.1	2,056	3.6	7	-------	(1)	-------	1,802	3.2	57,018	100.0
1913	50,168	84.1	5,486	9.2	37	.1	2,192	3.7	15	-------	(1)	-------	1,745	2.9	59,643	100.0
1914	32,424	81.6	4,581	11.5	36	.1	1,387	3.5	(1)	-------	(1)	-------	1,286	3.3	39,714	100.0
1915	47,334	85.3	5,237	9.4	40	.1	1,690	3.0	(1)	-------	(1)	-------	1,192	2.2	55,493	100.0
1916	66,394	85.3	7,054	9.1	35	-------	2,552	3.3	(1)	-------	(1)	-------	1,836	2.3	77,871	100.0
1917	63,854	84.5	7,314	9.7	39	.1	2,380	3.1	(1)	-------	(1)	-------	1,986	2.6	75,573	100.0
1918	62,018	86.1	6,383	8.9	72	.1	1,791	2.5	53	-------	(1)	-------	1,704	2.4	72,021	100.0
1919	48,341	85.8	4,969	8.8	54	.1	1,655	2.9	44	.1	(1)	-------	1,308	2.3	56,371	100.0
1920	59,677	86.1	5,937	8.6	51	.1	2,096	3.0	36	.1	(1)	-------	1,484	2.1	69,281	100.0
1921	22,779	85.5	2,840	10.7	36	.1	476	1.8	61	.2	235	0.9	226	.8	26,653	100.0
1922	43,462	85.9	5,324	10.5	58	.1	1,064	2.1	15	-------	333	.7	357	.7	50,613	100.0
1923	59,452	85.1	7,040	10.1	54	.1	2,060	3.0	58	.1	379	.5	768	1.1	69,811	100.0
1924	43,111	82.8	6,670	12.8	80	.2	1,211	2.3	164	.3	363	.7	484	.9	52,083	100.0
1925	54,209	84.8	6,970	10.9	40	.1	1,496	2.3	269	.4	490	.8	451	.7	63,925	100.0
1926	58,900	85.0	6,923	10.0	124	.2	1,961	2.8	297	.4	630	.9	458	.7	69,293	100.0
1927	51,034	83.3	6,558	10.7	79	.1	2,265	3.7	223	.4	603	1.0	470	.8	61,232	100.0
1928	53,764	84.8	6,233	9.8	95	.1	2,133	3.4	321	.5	491	.8	396	.6	63,433	100.0
1929	65,099	86.1	6,696	8.9	171	.2	2,312	3.1	325	.4	639	.8	361	.5	75,603	100.0
1930	46,469	84.2	5,690	10.3	133	.2	2,041	3.7	279	.5	320	.6	269	.5	55,201	100.0
1931	23,248	81.5	3,651	12.8	112	.4	936	3.3	184	.7	181	.6	204	.7	28,516	100.0
1932	3,578	67.1	1,471	27.6	25	.5	120	2.2	137	2.6	-------	-------	-------	-------	5,331	100.0
1933	21,497	87.3	2,156	8.7	-------	-------	560	2.3	95	.4	289	1.2	27	.1	24,624	100.0
1934	21,862	84.8	2,722	10.5	4	-------	905	3.5	161	.6	117	.5	22	.1	25,793	100.0
1935	27,993	83.7	3,563	10.7	2	-------	1,329	4.0	161	.5	339	1.0	39	.1	33,426	100.0
1936	44,349	86.2	4,266	8.3	3	-------	2,100	4.1	154	.3	507	1.0	87	.1	51,466	100.0
1937	61,925	85.6	6,365	8.8	20	-------	3,092	4.3	189	.2	708	1.0	49	.1	72,348	100.0
1938	19,254	72.8	4,290	16.2	21	.1	2,373	9.0	170	.6	276	1.1	47	.2	26,431	100.0
1939	44,784	81.7	6,011	11.0	37	.1	3,089	5.6	262	.5	588	1.0	56	.1	54,827	100.0
1940	62,884	83.6	7,430	9.9	50	.1	3,637	4.8	327	.4	831	1.1	39	.1	75,198	100.0
1941	79,564	85.5	8,132	8.7	13	-------	3,923	4.2	355	.4	986	1.1	71	.1	93,054	100.0
1942	91,543	86.9	9,143	8.7	56	-------	3,076	3.0	320	.3	957	.9	219	.2	105,314	100.0
1943	84,537	85.5	8,473	8.6	53	.1	3,219	3.3	912	.9	814	.8	809	.8	98,817	100.0
1944	80,697	85.3	7,094	7.5	19	-------	3,504	3.7	1,541	1.6	714	.8	994	1.1	94,545	100.0

1945	74,699	85.3	6,315	7.2	113	.1	3,369	3.9	1,926	2.2	606	.7	553	.6	87,581	100.0
1946	58,631	84.4	6,279	9.0	156	.2	2,230	3.2	1,321	1.9	619	.9	258	.4	69,494	100.0
1947	76,945	83.0	7,503	8.1	171	.2	3,901	4.2	2,821	3.0	651	.7	679	.8	92,671	100.0
1948	82,287	82.1	[2] 8,298	8.3	165	.2	4,491	4.5	3,233	3.2	690	.7	1,111	1.1	100,275	100.0
1949	68,340	81.5	7,434	8.9	[1]	-------	[3] 3,770	4.5	2,580	3.1	563	.7	1,214	1.4	83,901	100.0

[1] Tonnage included in "Other States."
[2] Small tonnage of Virginia included.
[3] Estimates.

Source: Steel Magazine, Nov. 21, 1949: Their Authority: U. S. Department of the Interior, Bureau of Mines.

TABLE A–2.—*Receipts of iron ore by the 9 principal producers and total net receipts of all consumers in the United States, 1948*

[In thousand gross tons]

District	Total net receipts, all companies	Percent	Total receipts, 9 companies	Percent	United States Steel Corp.	Percent	Bethlehem Steel Corp.	Percent	Republic Steel Corp.	Percent	Jones & Laughlin Steel Corp.	Percent	Youngstown Sheet & Tube Co.	Percent	Inland Steel Co.	Percent	National Steel Corp.	Percent	Armco Steel Corp.	Percent	Wheeling Steel Corp.	Percent
Lake Superior	82,289	79.2	67,811	77.7	31,473	80.1	7,327	50.1	6,247	69.7	4,807	86.4	5,258	98.5	4,516	97.1	4,513	98.9	1,951	80.5	1,719	90.8
Pennsylvania	} 4,055	3.9	{2,121	2.4	------	------	2,121	14.5	------	------	------	------	------	------	------	------	------	------	------	------	------	------
New York			{3,074	3.5	1	(1)	812	5.5	1,428	15.9	756	13.6	------	------	------	------	------	------	------	------	77	4.1
New Jersey	436	.4	113	.1	------	------	60	.4	14	.1	------	------	------	------	------	------	------	------	39	1.6	------	------
Alabama	8,024	7.7	5,982	6.9	5,344	13.6	------	------	638	7.1	------	------	------	------	------	------	------	------	------	------	------	------
Georgia	274	.3	363	.4	------	------	------	------	363	4.1	------	------	------	------	------	------	------	------	------	------	------	------
Tennessee, Virginia, Delaware [2]	547	.5	201	.2	166	.4	------	------	33	.4	------	------	------	------	------	------	------	------	2	.1	------	------
Texas	746	.7	272	.3	------	------	------	------	------	------	------	------	------	------	------	------	------	------	272	11.2	------	------
Utah	3,233	3.1	1,936	2.2	1,934	4.9	2	(1)	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Missouri	165	.2	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Nevada	9	(1)	5	(1)	------	------	5	.1	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Other [3]	1,044	1.0	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Total United States	100,822	97.0	81,878	93.7	38,918	99.0	10,327	70.6	8,723	97.3	5,563	100.0	5,258	98.5	4,516	97.1	4,513	98.9	2,264	93.4	1,796	94.9
Chile	2,632	2.5	2,572	3.0	------	------	2,572	17.6	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Sweden	1,359	1.3	1,430	1.6	160	.4	1,270	8.7	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Canada	986	1.0	624	.7	------	------	28	.2	236	2.7	------	------	79	1.5	135	2.9	48	1.1	1	.1	97	5.1
Algeria	405	.4	293	.3	------	------	293	2.0	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Brazil	296	.3	249	.3	240	.6	------	------	------	------	------	------	------	------	------	------	------	------	9	.4	------	------
Spain	15	(1)	105	.1	9	(1)	96	.6	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Tunisia	56	.1	28	.1	------	------	28	.2	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Cuba	34	(1)	2	(1)	------	------	2	(1)	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Other	325	.3	170	.2	------	------	20	.1	------	------	------	------	------	------	------	------	------	------	150	6.1	------	------
Total foreign	6,108	5.9	5,474	6.3	409	1.0	4,309	29.4	236	2.7	------	------	79	1.5	135	2.9	48	1.1	160	6.6	97	5.1
Less exports [4]	3,081	2.9	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Grand total	103,849	100.0	87,352	100.0	39,327	100.0	14,636	100.0	8,959	100.0	5,563	100.0	5,337	100.0	4,651	100.0	4,561	100.0	2,424	100.0	1,893	100.0

[1] Less than 0.05 percent.
[2] Byproduct ore obtained from pyrites treated in, but not necessarily mined in, States indicated.
[3] Includes: California, 345,863 tons; Wyoming, 689,591 tons; Washington, 5,364 tons. Kaiser accounts for most of the California ore and Colorado Fuel & Iron for the Wyoming ore.
[4] Exports are totals reported at ports of exportation and are not reported by original source of supply.

NOTE.—Totals may not add, due to rounding.
Source: Net receipts, all companies, from Minerals Yearbook, 1948, and the 9 reporting companies from reports to FTC.

TABLE A–3.—*Summary of iron ore receipts, 1948, by 9 principal producers of iron and steel*

	Receipts	
	Million gross tons	Percent of total
1. United States Steel Corp.:		
Domestic, own mines:		
(*a*) Operated by company	37.6	95.7
(*b*) Operated by Pickands Mather & Co	.8	2.0
Total, own mines	38.4	97.7
Purchases	.5	1.3
Imports	.4	1.0
Total receipts	39.3	100.0
2. Bethlehem Steel Corp.:		
Domestic, own mines:		
(*a*) Operated by company	1.1	7.7
(*b*) Operated by Pickands Mather & Co	5.2	35.4
(*c*) Operated by Cleveland-Cliffs Iron Co	.7	4.7
(*d*) Operated by M. A. Hanna Co	(1)	.3
Total, own mines	7.0	48.1
Purchases	3.3	22.5
Imports, own mines (Chile)	2.6	18.0
Imports, purchases	1.7	11.4
Total receipts	14.6	100.0
3. Republic Steel Corp.:		
Domestic, own mines:		
(*a*) Operated by company	3.6	40.5
(*b*) Operated by Pickands Mather & Co	.4	4.6
Total, own mines	4.0	45.1
Purchases	4.7	52.2
Imports	.2	2.7
Total receipts	8.9	100.0
4. Jones & Laughlin Steel Corp.:		
Domestic, own mines:		
(*a*) Operated by company	4.0	72.2
(*b*) Operated by Cleveland-Cliffs Iron Co	.2	3.5
Total, own mines	4.2	75.7
Purchases	1.4	24.3
Imports		
Total receipts	5.6	100.0
5. Youngstown Sheet & Tube Co.:		
Domestic, own mines:		
(*a*) Operated by Pickands Mather & Co	3.7	68.7
Purchases	1.6	29.9
Imports	(1)	1.4
Total receipts	5.3	100.0
6. Inland Steel Co.:		
Domestic, own mines:		
(*a*) Operated by company	1.1	24.4
(*b*) Operated by Cleveland-Cliffs Iron Co	.4	8.4
(*c*) Operated by Pickands Mather & Co	.3	6.1
(*d*) Operated by M. A. Hanna Co	.3	6.6
(*e*) Operated by Republic Steel Corp	.3	7.2
Total, own mines	2.4	52.7
Purchases	2.1	44.4
Imports	.1	2.9
Total receipts	4.6	100.0

[1] Less than 100,000.

NOTE.—Totals may not add, due
Source: Net receipts, all companies, from Minerals Yearbook, 1948, and the reporting companies

TABLE A–3.—*Summary of iron ore receipts, 1948, by 9 principal producers of iron and steel*—Continued

	Receipts	
	Million gross tons	Percent of total
7. National Steel Corp.:		
Domestic, own mines:		
(a) Operated by M. A. Hanna Co	3.6	78.6
(b) Operated by Republic Steel Corp	.3	7.0
(c) Operated by Pickands Mather & Co	.3	5.9
(d) Operated by Cleveland-Cliffs Iron Co	.2	3.9
Total, own mines	4.4	95.4
Purchases	.2	3.5
Imports	(1)	1.1
Total receipts	4.6	100.0
8. Armco Steel Corp.:		
Domestic, own mines:		
(a) Operated by M. A. Hanna Co	.3	12.7
(b) Operated by Oglebay, Norton & Co	.2	8.5
Total, own mines	.5	21.2
Purchases	1.7	72.2
Imports	.2	6.6
Total receipts	2.4	100.0
9. Wheeling Steel Corp.:		
Domestic, own mines:		
(a) Operated by company	.2	11.8
(b) Operated by M. A. Hanna Co	.7	38.8
(c) Operated by Cleveland-Cliffs Iron Co	.3	13.2
(d) Operated by Oglebay, Norton & Co	.2	11.8
Total, own mines	1.4	75.6
Purchases	.4	19.3
Imports	.1	5.1
Total receipts	1.9	100.0
Total for 9 companies:		
Domestic, own mines:		
(a) Operated by company	47.7	54.7
(b) Operated by M. A. Hanna Co	5.0	5.7
(c) Operated by Pickands Mather & Co	10.6	12.2
(d) Operated by Cleveland-Cliffs Iron Co	1.7	1.9
(e) Operated by Oglebay, Norton & Co	.4	.5
(f) Operated by Republic Steel Corp	.7	.7
Total, own mines	66.1	75.7
Purchases	15.7	18.0
Imports, own mines	2.6	3.0
Imports, purchases	2.9	3.3
Total receipts	87.3	100.0

[1] Less than 100,000.

Source: FTC questionnaires.

TABLE A–4.—*Reserves of mining companies and ore properties managed by Cleveland-Cliffs Iron Co. and allocated to the stockholders in proportion to their respective stock interests, as of Jan. 1, 1949*

[In thousand gross tons]

Property and present ownership	Total reserves	Direct-shipping		Concentrating		Potential ore, open-pit
		Open-pit	Underground	Open-pit	Underground	
Minnesota properties	33,294	2,794	4,432	26,068		
Total reserves in Minnesota reported by Cleveland-Cliffs include the reserves of the Mesaba-Cliffs Mining Co. which must be allocated and deducted as follows:						
Pittsburgh Steel Co. (16 percent)		26		2,075		
Wheeling Steel Corp. (15.8 percent)		24		1,972		
Jones & Laughlin Steel Corp. (14.2 percent)		19		1,517		
Hanna Iron Ore Co. (11.7 percent)		17		1,388		
Inland Steel Co. (10.7 percent)		23		1,841		
	8,902	109		8,793		
Also reserves of Atkins Mine as follows: Inland Steel Co. (50 percent)	421	421				
Total Minnesota reserves owned by Cleveland-Cliffs Iron Co	23,971	2,264	4,432	17,275		
Michigan properties [1]	60,126	11,000	49,126			[2] 34,913
Total reserves in Michigan reported by Cleveland-Cliffs include the reserves of Negaunee Mining Co. which must be allocated and deducted as follows: Bethlehem Steel Corp. (50 percent)	13,394		[2] 13,394			
Also reserves of Athens Iron Mining Co. as follows: Dalton Ore Co. (41.595 percent)	1,365		[2] 1,365			
Total Michigan reserves owned by Cleveland-Cliffs Iron Co	45,367	11,000	34,367			[2] 34,913
Total Lake Superior reserves owned by Cleveland-Cliffs Iron Co	69,338	13,264	38,799	17,275		[2] 34,913

[1] Includes Cleveland-Cliffs' proportion of the reserves of Lucky Star Mining Co. (25 percent), Bunker Hill Mining Co. (68.067 percent), and Arctic Iron Co. (50 percent).
[2] Assumed to be underground since past production was underground.
[3] Reported as concentrate tonnages of 62.30 percent iron.

TABLE A–5.—*Domestic reserves of M. A. Hanna Co. as of Jan. 1, 1949*

[In 1,000 gross tons]

Company and percent ownership	Total reserves	Direct-shipping		Concentrating	
		Open-pit	Underground	Open-pit	Underground
Hanna Coal & Ore Corp. (60 percent):					
Minnesota properties	14,356	2,557	5,616	5,711	472
Michigan properties	4,067		4,067		
Morton Ore Co. (100 percent)	2,271		2,271		
Douglas Mining Co. (65 percent), (entitled to 30 percent of reserves)	3,595	870	1,696	413	616
Total, Lake Superior	24,289	3,427	13,650	6,124	1,088
Hanna Coal & Ore Corp., New York properties	400				400
Ozark Ore Co. (100 percent), Missouri properties	2,850			290	2,560

NOTE.—Consumers Ore Co. (30 percent class A stock)—Hanna Coal & Ore Corp. has option to purchase from Consumers Ore Co. up to 200,000 tons per year during each of the years 1949 to 1958, inclusive.

TABLE A–5 (a).—*Domestic reserves of Butler Bros. as of Jan. 1, 1949*

[In 1,000 gross tons]

Company	Total	Direct shipping		Concentrating	
		Open pit	Underground	Open pit	Underground
Butler Bros.[1]	22,301	2,534	362	15,175	4,230
78.556 percent by Consumers Ore [2]	17,520	1,991	285	11,921	3,323
Left to Butler Bros.' account	4,781	543	77	3,254	907
Philbin Mining Co.:					
50 percent Butler Bros	1,272	683	24	362	203
50 percent Inland	1,272	683	24	362	203
South Agnew Mining Co.:[3]					
40 percent Butler Bros	4,158	2,510	1,248	400	----------
60 percent Bethlehem	6,238	3,765	1,873	600	----------
Total for Butler Bros.' account	10,211	3,736	1,349	4,016	1,110
Allocation of Consumers Ore Co.'s reserves:					
Armco (40 percent)	7,008	796	114	4,769	1,329
Inland (30 percent)	5,256	597	86	3,576	997
Wheeling (30 percent)	5,256	597	86	3,576	997

[1] 21.444 percent ownership in Butler Bros. unknown.

[2] Butler Bros.' reserves in Philbin Mining Co. and South Agnew Mining Co. not included in the reserves allocated to Consumers Ore Co., and the respective owners of Consumers Ore Co.—Armco, Inland, and Wheeling.

[3] South Agnew Mining Co.'s supplemental questionnaire reported that stockholders take all ore produced by it from the South Agnew mine and 60 percent of the ore produced from the Agnew No. 2 mine in the proportion of their respective stock interests. Bethlehem has contract to purchase 40 percent of the production of the South Agnew mine until mine is exhausted—2,558,000 tons. However, reserves of both mines have been allocated 60 percent to Bethlehem and 40 percent to Butler Bros.

TABLE A–6.—*Domestic reserves of mining companies and ore properties managed by Pickands Mather and allocated to the stockholders in proportion to their respective stock interests as of Jan. 1, 1949*

[In 1,000 gross tons]

Company	Total reserves	Direct-shipping		Concentrating	
		Open-pit	Underground	Open-pit	Underground
Producers of steel:					
Bethlehem Steel Corp	42,745	14,513	26,622	572	1,038
Youngstown Sheet & Tube Co	46,419	13,450	25,494	4,442	3,033
Republic Steel Corp	2,327	1,279	986	56	6
Carnegie-Illinois Steel Corp	6,710	3,683	2,829	198	----------
Inland Steel Co	4,297	1,559	2,738	----------	----------
Steel Co. of Canada, Ltd	11,390	2,603	5,248	2,025	1,514
Pittsburgh Steel Co	889	246	561	62	20
International Harvester Co	564	293	260	----------	11
Nonproducers of steel:					
Hanna Iron Ore Co	2,237	1,228	943	66	----------
Shenango Furnace Co	958	526	404	28	----------
Dalton Ore Co., Mather Iron Co., and American Radiator and Standard Sanitary Corp.[1 2]	[3] 20,113	3,295	14,057	1,351	1,400
Total	138,649	42,675	80,152	8,800	7,022

[1] Totals for these companies were combined by Pickands Mather and cannot be allocated to the respective companies on the basis of their ownership in the properties managed by Pickands Mather.

[2] Up to 125,000 tons of the annual production of Pickands Mining Co. may be purchased by Pittsburgh Coke & Chemical on the basis of the division of ownership in Pickands Mining between Steel Co. of Canada and Dalton Ore. This tonnage has to be subtracted from the annual production of the mining company to which Steel Co. of Canada and Dalton Ore are entitled.

[3] Dalton Ore owns 41.6 percent of the Athens Iron Mining Co., managed by Cleveland-Cliffs. On the basis of this ownership Cleveland-Cliffs allocated 1,365,000 tons of direct-shipping (presumably underground) reserves to Dalton Ore, which must be added to 20,113,000 tons left to the account of Pickands Mather.

TABLE A–7.—*Domestic reserves of Oglebay, Norton & Co. as of Jan. 1, 1949*

[In 1,000 gross tons]

Company	Total reserves	Direct-shipping	
		Open-pit	Underground
Montreal Mining Co.[1]	4,955		4,955
Fortune Lake Mining Co.[2]	991		991
Castile Mining Co.[3]	681		681
Total (all Lake Superior)	6,627		6,627

[1] Montreal Mining Co. is operated by Oglebay, Norton & Co. but is owned 11.89 percent by United States Steel Corp., 21 percent by E. W. Oglebay Co., 2.69 percent by David Z. Norton Co., 18.11 percent by a personal living trust of which A. A. Welsh Co. is nominee, and small amounts by 30 to 35 individuals The reserves have been left to the account of Oglebay, Norton & Co., although they do not share in the ownership.

[2] Ownership unreported, although none of the stock is owned by a company producing iron or steel. However, the reserves have been left to the account of Oglebay, Norton & Co.

[3] Oglebay, Norton & Co. reported 681,000 tons of direct-shipping underground reserves for Castile Mining Co. Wheeling Steel has a 37½-percent ownership and Armco Steel has a 25-percent ownership. The balance of the stock is owned 13 percent by E. W. Oglebay Co., 15 percent by David Z. Norton Co.,9.5 percent by others. The company is not a "mutual" company. The ore was purchased under contract by Wheeling Steel and others; hence the reserves have not been allocated on the basis of ownership but have been left to the account of Oglebay, Norton & Co. Reserves were exhausted in 1950.

NOTE.—St. James mine has been allocated 75 percent to Bethlehem and 25 percent to Armco Steel in proportion to their stock interests, although managed by Oglebay, Norton.

TABLE A–8.—*Comparison of blast- and steel-furnace capacity and output of the 9 leading steel companies as percentages of the United States total, 1948*

[Thousand net tons]

Iron and steel producers	Capacity				Output			
	Blast furnaces		Steel furnaces		Blast furnaces		Steel furnaces	
United States total	67,439	*Percent* 100.0	94,233	*Percent* 100.0	60,849	*Percent* 100.0	88,534	*Percent* 100.0
All others than the 9 reporting companies	10,372	15.4	19,638	20.8	9,495	15.6	16,752	18.9
Total 9 reporting companies	57,067	84.6	74,595	79.2	51,354	84.4	71,782	81.1
United States Steel Corp	24,860	36.9	31,226	33.1	22,227	36.5	29,292	33.1
Bethlehem Steel Corp	9,870	14.6	13,800	14.7	8,764	14.4	13,412	15.1
Republic Steel Corp	6,327	9.4	8,600	9.1	5,604	9.2	8,324	9.4
Jones & Laughlin Steel Corp	4,060	6.0	4,742	5.0	3,866	6.4	4,634	5.2
National Steel Corp	3,120	4.6	4,050	4.3	2,929	4.8	3,986	4.5
Youngstown Sheet & Tube Co	3,502	5.2	4,002	4.3	3,085	5.1	3,966	4.5
Inland Steel Co	2,663	4.0	3,400	3.6	2,465	4.1	3,533	4.0
Armco Steel Corp	1,576	2.3	3,366	3.6	1,479	2.4	3,332	3.8
Wheeling Steel Corp	1,069	1.6	1,409	1.5	935	1.5	1,303	1.5

Source: Capacity data taken from American Iron and Steel Institute Annual Statistical Report, 1949 p. 12; production data from American Iron and Steel Institute, Form 7, December 1948; and the nine reporting steel companies' data from reports submitted to FTC.

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